

HEREDITY
IN MENTAL TRAITS



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HEREDITY IN MENTAL TRAITS

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ये नस्तद् व्यचचक्षिरे (ईशोपनिषत्)

“TO THOSE WHO TOLD US
OF THE TRUTHWARD WAY”

PREFACE

Nature, says T. H. Huxley, favours the survival of the fittest ; civilisation aims at making as many as possible fit to survive. This end can be achieved by a process of *selection* and guidance. Society must *select* talents that may be cultivated, each in its special direction. It must also *guide* individuals into vocations that are socially and economically valuable. The idea of educational, industrial and social planning has for this reason found a favourable medium in the culture of the present time.

Both selection and guidance imply a careful estimate of handicaps and abilities. The value of the prognosis suggested by them may depend on whether they are hereditary or acquired. It is affirmed from one point of view that the human personality, genetically viewed, is a *tabula rasa*. Environment and nurture are free to write almost anything on it. It is stated with equal emphasis from the other side that man is 'three-fourths cards and one-fourth play.' Our remote ancestors have vanished from the scene of life after dealing most of the cards that represent our mind and personality.

Such a clash of theories naturally brings into relief the hypothesis of mental inheritance. Its significance is magnified by the many problems and needs of modern social life. These comprise the training of the unfit, the placement of the vocationally 'inadequate' individuals, the mental prospects of the progeny of particular types of parents and a host of similar questions. It is recognised that a low-level personality is a social loss in the economic, industrial and educational sense. It is necessary to 'spot' the weakness at an early stage so that proper

measures may be taken to remedy the weakness so far as social efforts may achieve the end. A diagnosis of this type must take into consideration the hereditary setting of the individual. The problem of mental inheritance, therefore, assumes a deep practical meaning.

It is customary to-day to take a special notice of inheritance in many types of social diagnosis. The studies in delinquency, mental disorders, subnormality and scholastic inadequacies require a record of inheritance. The theoretic validity of these records then must be carefully assayed. A reprobate ancestor, if his failings appear on the record, may seal the social destiny of an individual by removing him from the setting of an ordinary school to that of one for problem children.

An analysis of the facts and fancies that bear on heredity in its psychological aspect is, therefore, important from many points of view. It is specially of value to the psychologist who is called upon to-day to bring his science to bear upon the many problems of social interpretation, diagnosis and selection. Several of the issues are also significant for the sociologist in so far as he attempts to approach his problems through the avenue of psychology. The educational science that seeks to-day, an ever-increasing degree of filiation with psychology can, least of all afford to remain indifferent to the question of mental heredity.

The belief in the inheritance of mental traits commonly rests on anecdotes. It is necessary to define certain special concepts and methods for a more precise approach to heredity in the psychological sphere. This is attempted in the following chapters. Secondly, the facts that really bear upon the issues are seldom subjected to logical analysis and scrutiny. An assay of the data is attempted from this perspective.

Lastly, the studies in mental inheritance very often begin with a statement of the facts and theories of physical inheritance. It is tacitly assumed that an affirmation of the general biological theory is sufficient to establish the hypothesis in the sphere of mind. There are, however, certain special difficulties that arise in the observation of the resemblances that supply the basis of Psychological Genetics.

This volume tries to adjudge whether the similarity between ancestors and descendants is truly due to heredity. In many cases the similarities represent the influence of a common environment. In other cases they represent the effect of nurture. In certain other instances, as in the case of the neuropathic subjects, even wide differences of symptoms may be traced to a common hereditary *Anlage*. It has thus been necessary to examine the hypotheses of inheritance in the special context of each definable range of facts. A critical survey of authentic data leads to the conclusion that our belief in the hereditary transmission of a considerable number of mental traits has no sure foundation in facts. The evidence is strong in some cases ; it raises a bare presumption in others ; and it yields no definite conclusion in still others. There is no simple and unqualified answer to the question "Are mental traits heritable ?"

The substance of some of the chapters was delivered in the form of three lectures under the auspices of the Faculty of Science, University of Lucknow. I am grateful to my esteemed colleague Professor Birbal Sahni, F.R.S., for his kind invitation to deliver the lectures. I am grateful to Professor Radhakumud Mukerjee, my teacher and now my colleague, for his kind advice, encouragement and help in arranging for the publication of the volume. It is alike my pleasure and duty to express my gratitude to my friend Professor Hari Das Bhatta-

charyya, Head of the Department of Philosophy, University of Dacca, for reading through some of the chapters of the typescript with his usual discernment, for suggesting several important changes and for putting me in touch with some literature which would not have been available to me but for his kind help.

My son, Arun Sen Gupta, B.Sc., has prepared the genealogical charts for me. Mr. M. R. N. Iyengar has prepared the typescript and the index and has helped me in correcting the proofs. I thank both of them.

The University,
Lucknow, India.
January, 1941.

N. N. SEN GUPTA.

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CHAPTER I

THE GENERAL CONCEPTION OF MENTAL INHERITANCE.

§ 1. *Introductory*

The problem of heredity in mental traits is overlaid with facts and fancies, sense and nonsense. It is hedged round by the irritating naïveté of common prejudices as also by the disarming obstinacy of scientific half-truths. Even when we have sifted the facts, only a fraction of which can be marshalled within the compass of these chapters, it is doubtful whether the process will leave any precipitate of intellectual certainty.

It is, however, necessary to consider what feature is inherited. In the case of the body we can point out a number of visible items such as complexion, the cut of the face or the stature. Some of these characters are called in Biology 'unit characters'. In fact the physical personality may be regarded as an aggregate of these unit characters. Each species, therefore, may be regarded as representing certain patterns of unit characters. In the case of mind it becomes very difficult to point out such unit features or unit mental functions which can be transmitted from one generation to another. For this reason the question of inheritance of mental traits may lead us to very different theoretic standpoints.

Two opposite views are usually maintained in regard to the question of inheritance of mental traits. It is widely believed on the one hand that every whim and caprice, every mental crisis and emotional stress of the parents reflect themselves in the physical and mental history of the progeny. The psychic life of the immediate and even remote ancestors, in some way, influences

the seeds of race and projects itself across the barriers of time into the mind of the later generations. On the other hand it is held with equal emphasis that the mind of parents has but little contribution to make to the psychic capital of the offspring. It can certainly shape the environment in which the child grows up. It can also determine the process of nurture which elicits from life the responses that we call mind and behaviour. There is no other sense in which one mental trait issues forth from an antecedent trait. Yet the mental resemblances between parents and the offspring as also among the collaterals of a family, are too many to be lightly dismissed. Several of the traits, again, are of such a character that their occurrence cannot be satisfactorily accounted for in terms of either environment or training. We are thus compelled in many cases to postulate inheritance for their interpretation.

§ 2. *Mental Traits*

The approach to the problem of inheritance in the sphere of mind must be through a clear definition of the conception of "trait" which is said to be transmitted. The difficulties in the way of defining the mental "unit"-characters have been already referred to. There are four main reasons that render the task difficult :

- (i) The mental states are too varied in quality, it is said, to be resolved into any manageable number of units.
- (ii) It is said that a mental process such as attention or emotion, is essentially a process in time. If the value of the time factor be increased or decreased, the quality of the psychic state too undergoes a change.
- (iii) A mental-process that occurs in the context of one group of experiences cannot, in theory, be equated with another experience, however

numerous the points of correspondence may be. It is possible only to establish a correlation between one such configuration of factors and another.

- (iv) Mental functions interlace with the stimulus situation. There is a perpetual process of give and take between the mental and the stimulus patterns. Hence, it is very difficult to define the mental function in isolation from the external stimulus.

We should attempt, however, to formulate at least a provisional definition of the concept of *trait*. Such a formulation is essential for reaching a conclusion, positive or negative, in regard to the problem of psychic heredity. It is not necessary to meet the difficulties that have been mentioned above on their own grounds. A consideration of these as abstract propositions may lead us into a morass of logic from which we may not be able to extricate ourselves.

We begin with the fact that ordinary experience and experimental observation both show rough and ready resemblances between the reactions of individuals belonging to the same family. There are certain situations too which elicit markedly similar mental and behavioural responses from the members of the same family group. The problem, then, is to attempt at a provisional definition of the term *mental trait*. We shall understand the term in one of the following senses :

- (i) A trait is observable as a specific psychic quality in introspection, e.g., image-type, sensory-acuity.
- (ii) A trait exhibits itself in a specified *form* of behaviour which maintains itself under varying circumstances, e.g., a fear or an anger response ; the "form" in games.
- (iii) A trait is that which in introspection or behaviour is durable in character. It des-

cribes similar time-curves and exhibits similar quality-phases on different occasions.

- (iv) A trait, again, cannot easily be modified through a change of external conditions, e.g., synaesthesia.

§ 3. *The Conception of Mental Heredity*

Heredity is usually defined as organic resemblances based on descent. This definition would not fit in with the problem which we have so far formulated. We may define heredity in the sphere of mental life in the following manner :

- (i) A trait when it is inherited, will be found to be possessed by a number of ancestors and a number of descendants.
- (ii) When such traits can be represented in terms of numerical values, a correspondence or correlation will be found between the trait-values of ancestors and those of descendants. For instance, if the trait in question be musical ability, the degree of success attained by individuals or successful generations may exhibit the correspondence in one form. Another way in which such correspondence can be worked out would be in terms of the number of individuals who may be found to possess the traits. If the ratio of the number of persons possessing musical abilities and those not possessing it in the grand-parent order corresponds to the same ratio in the great-grandchildren order, there would be a presumption of inheritance.

But such supposition of inheritance must always be made when the possession of the trait in question cannot be explained either in terms of environment or training. The coefficient or correlation between the traits, then,

may be large or small in proportion to the intensity of the heredity factor. Such intensity is to be estimated in terms of the number of direct ancestors and the number of siblings possessing the traits in question.

Galton in his description of hybridisation subsumes inheritance under three heads : (i) Blending, in which the traits from both parents fuse into a complex possessing new features. (ii) Alternative inheritance in which the parental traits do not lose their individuality ; one or the other reappears intact in the offspring (iii) Particulate inheritance in which the ancestral traits form a mosaic in the offspring. It is not possible in the case of mental heredity to speak of blending inheritance. For, the new mental feature will so effectively integrate the simpler traits that their identity would not be perceived. We can speak with a little more assurance of *particulate inheritance*. It will be shown later that many of the trait-complexes are inherited in the *particulate form*. The clearest examples of heredity, however, are given by what has been called *alternative inheritance*. It may be said with a great deal of truth that the simpler mental traits such as the sensory phenomena, exhibit alternative inheritance. The inheritance of the more complex mental phenomena such as the various types of mental diseases and complex abilities exhibit the *particulate type* in Galton's sense.

§ 4. *The Methods of Study*

Biologists have usually approached the problem of heredity by three methods : (i) Examination of the germ-cells ; (ii) Experimental breeding ; (iii) Statistical examination of the data. The first two of these methods cannot for obvious reasons be employed in the case of mental inheritance. The technique of study in the problem of heritability of mental traits must, then, largely be statistical in character.

In fact, this is the method that is usually employed when the trait in question can easily be identified and when the number of cases to be studied is large. The

procedure consists (i) in noting the frequency of a trait among the members of a number of family groups which are found to possess it. (ii) Secondly, the same trait is studied among a number of sample groups in which the members are not related to one another. We obtain in this manner two percentages of the frequency of the traits. If the percentage be higher in the family groups there would be a presumption of a hereditary factor. If the higher percentage cannot be explained in terms either of environment or nurture, the presumption of inheritance would be strengthened.

For instance, if we find that 60% of the individuals belonging to several family groups possess musical ability, and if only 15% of the individuals belonging to certain other families of the same social order are musical, the former higher percentage would be presumed to be due to inheritance. This presumption is always subject to the condition that the fact cannot be explained either in terms of environment or special training.

A second method which has been pursued with success and has carried more conviction, is that of tracing the pedigree of persons possessing a particular, usually a rare, trait. It is this method that has been followed very largely in the study of amentia and several other abnormal traits. It will be discussed in greater detail in another chapter. A common instance of this method is found in the study of such rare traits as colour-blindness and *synaesthesia*.

A third method consists in the study of twins and siblings under different conditions of nurture and environment. Let us illustrate the method. In the monozygotic or identical twins the factor of heredity must possess as little difference in value as it is possible to conceive. If such twins are brought up under different conditions and receive different kinds of training, whatever differences they may exhibit in their traits should mainly be attributed to nurture and environment. Conversely, if the differences be much less than are to be expected of unrelated pairs of individuals of similar age and con-

ditions of life, such likeness would be thought of as arising from heredity. A very large number of such studies has been carried on in Germany, Italy and America during the past fifteen years. The general conclusion of these strengthens the hypothesis of inheritance of mental traits.

§ 5. *The Practical Implications of the Concept of Inheritance*

The conception of hereditary transmission of mental traits possesses several practical implications. It has its principal bearing in the field of education.

- (i) School surveys in all countries would reveal the existence of a presumably sub-educational group. A question would arise in regard to the effort that has to be made for improving the condition of these children. All such measures would mean expenditure on the part of the state. It should also be presumed that such expenditure and such educational measures will be really for the benefit of the pupils in question. A study of the family group and the probable influence of inheritance may be important for the solution of the problem. It may be that additional expenditure for the improvement of the children who are "dull" by virtue of inheritance would be sheer waste ; for, there would be no corresponding change in the condition of the pupils. It may also be that special measures suited to the mental level of these children, such as a course of training in handicrafts, would prove to be of more value. Thus, a consideration of the question of inheritance becomes a matter of great practical importance.
- (ii) In the same way, there are pupils with superior ability. To herd them together with the

average and the below-average children would mean a slowing down of the rate of their mental growth. It is in the interest of the children, as also of the state, to ensure that each person is given the best opportunities according to his ability.

- (iii) Thirdly, there are certain individuals with special defects and abilities. Some are deficient in memory, others in imagination. There are numerous possible deficiencies of this character. Special measures adopted for a certain length of time would tide these pupils over their defects. In time they would catch up with the rest of their fellow-students. It is often found that certain pupils who do not excel in the school or in the college attain great success in vocational life. Sometimes the reason is as follows : In India, particularly, the school subjects are overweighed with tasks that implicate memory. There is also a certain preference given to studies that foster imagination. Hence, the students who are lacking in these functions cannot normally excel in their early educational career. Some of these possess a greater sense of facts, social tact, a capacity of formulating projects and a balanced judgment. These qualities are of great import for vocational and social success. The defects of memory and imagination, however, can often be explained in terms of inheritance. There are certain families which possess the capacity of imagination or that of memory to a marked extent. Others are lacking in both of these. The study of the individual pupil in the family setting would be of help in diagnosing the true character of his defect and "lag" in the achievements in school. It will also enable the teacher to render the kind of

special help that would compensate for the deficiency.

- (iv) There is, again, the problem of pathological children. It is well known that the heredity of Dementia Praecox often trails down to the third generation. The same thing is true in the case of several other types of mental diseases. The children from such pathological families should be treated with a special measure of care. For, the seed of disturbance, it is well known, is often sown in the early years of life. A new routine and more considerate methods of treatment should be devised for children with neurotic inheritance. This may prevent a mental breakdown in their later life.
- (v) The question of mental inheritance has also a bearing upon the field of vocation. It is said that certain temperaments are more suitable for a specific type of vocation. An energetic and extrovert type of personality is more suited to the needs of canvassing and salesmanship. A schizoid personality, on the other hand, is less effective in this field of business. It is thus reasonable to suppose that a vocational selection in accordance with the temperament should give the individual a surer footing in his profession. But temperament is not fixed for all times. It often exhibits marked variations as the individual passes through the vicissitudes of life. And it is also dependent, as it is now supposed, upon the body-type of the individual. This, in its turn, is hereditary in character. In the case of vocational selection, therefore, the dimensions of character and temperament should be analysed in the context of inheritance. A

person with a dubious family history should be supposed to be less reliable in regard to the stability of some of the nicer traits of character. The task of vocational guidance would thus implicate a close examination of the psychological inheritance of the individual.

The problem of inheritance of mental traits then brings with it many implications, theoretic and practical. The biologist will be interested in the question in regard to the manner in which transmission takes place. To the psychologist, the fact of hereditary transmission itself is a point of great interest. It clearly shows that the mental life has to be explained in terms of determinants other than the stimuli of the environment, the social situation and the past history of the individual. It also reveals the evolutionary history of traits that come down to the modern man with secret marks that ages long past have scribbled upon them.

In addition to these questions of theory, supremely interesting in themselves, there are the problems of practical application. In every case of training and selection of individuals with definite patterns of traits, the question of heredity must be taken into consideration. It is only when we have surveyed the evidence of inheritance of mental traits that the possibilities of application of our knowledge can be duly appreciated. The following chapters will present the evidence that we possess in regard to the inheritance of mental traits. We shall also consider the social and educational problems that the question of inheritance of particular traits will implicate. Lastly, we shall discuss the hypotheses that are put forward for the interpretation of the various orders of facts.

CHAPTER II

SENSORY AND IMAGINAL TRAITS.

§ 1. *Racial Distribution of Sensory Abilities*

It is well known that races differ with respect to their sensory capacities, some of them possessing a greater ability to sensory discrimination than others. As early as 1865 it was found that men of San Christoval could discern things from a great distance. Their power of visual observation seemed almost to be phenomenal to people of other races. They could see pigeons which were hidden behind the thick foliage of spreading trees. A similar observation was made in 1885 of the natives of New Ireland. It was found that their visual observation was much more acute than that of the people of other races. The authorities of the United States Army, tested the visual acuity of four racial groups in their army. Arranged in order of merit they stand thus : Iroquois Indians, Whites, Mulattoes, Full Blacks (1). The Cambridge Anthropological Expedition to the Torres Straits, again, found that the islanders could see small sailing vessels at distances far beyond the visual span of the white people (2). A racial distribution of this character can be explained in terms of either heredity or environment. On the whole, the heredity factor seems to be a more probable hypothesis in the light of the facts that are set forth below.

Garth has studied the colour preference of 559 full-blooded Indians and has compared these data with those obtained from a study of other racial groups. It is found that the full-blood Red Indians have only three agreements in their colour preference with whites, but none with the mixed bloods. The observation made in the

course of these field surveys were subsequently verified by tests applied to the educational sub-classes of the same racial groups. The data of the second survey very closely correspond to those of the first. The following table will set forth Garth's conclusions :

TABLE I.

	R a n k.						
	1	2	3	4	5	6	7
Full Bloods	Red	Blue	Violet	Green	Orange	Yellow	White
Mixed Bloods	Blue	Red	Violet	White	Green	Orange	Yellow
Whites	Blue	Green	Red	Violet	Orange	Yellow	White

Such divergence of colour preference on racial lines implicates a hereditary factor. As Garth says : "From a statistical standpoint as from the standpoint of judgment scales, the data indicate racial differences in colour preference between full bloods and whites, and, by the test of overlapping, between the full bloods and the mixed bloods. But the differences are not so great for them." (3)

It has been found further that the eye of the Melanesian adjusts itself to the dark more quickly than that of the European. Guppy believes that this is due to the larger size of the pupils in the dark races. But the more reasonable hypothesis seems to be, according to the authorities of the Cambridge Anthropological Expedition, that the eye shares in a large amount of pigments in the dark races, and thus the *visual purple* may be formed more readily and rapidly (4). Such a physiological equipment undoubtedly implicates a heritable basis.

§ 2. *Certain Sensory Defects*

We pass on to consider the facts bearing upon certain atypical sensory phenomena. The most common of

these is colour-blindness. Galton noticed a larger frequency of colour-blindness among the Quakers, the percentage being 5.9. Among the rest of the community, however, it is only 3.5. Galton explains this fact of larger frequency in the following way: "Nearly every Quaker is descended on both sides solely from members of a group of men and women five or six generations ago, one of their strongest opinions being that fine arts were worldly snares." "A born artist," opines Galton, "could never have consented to separate himself from his fellow-men on such grounds." Hence, it is argued that very few of the original stock of Quakers could have been endowed with a well-developed colour-sense. The phenomenon of colour-blindness among the Quakers has originated, according to this hypothesis, from hereditary factors and a process of selective breeding (5). The Cambridge Anthropological Expedition found that Yellow-Blue colour-blindness, which is extremely rare among the European population, was common among the Torres Straits Islanders. It is reasonable to account for this fact too as a consequence of heredity and selective breeding.

Atypical sensory functions of other kinds seem to bear out the above conclusion. A peculiar form of taste deficiency has been discovered both in Europe and Japan. It is a deficiency with respect to Di-phenylguanidine. Rikimaru reports it of the Japanese in Formosa, and Snyder and Davidson of the whites. In both of these cases, the authors assign the deficiency to heredity (6). A similar work is reported by Cook. It is found that for about half the people, Phenyl-thio-Carbamide has no taste. For the other half, it has a bitter taste. Blakeslee, of the Carnegie Institute, has tested the families of these persons. The conclusion is that the taste deficiency very closely follows the Mendelian Ratio (7). Olfactory deficiency, too, seems to follow a hereditary track. Thus, Nysson has found anosmia, the absence of the capacity to sense odors, in several generations of a family (8).

The instances of these sensory phenomena which we

have so far surveyed, very strongly suggest that they rest on a hereditary basis. Most of these are of such a character that they do not usually draw the attention of the people to those who possess them. They do not, in most cases, impair the capacity of the persons concerned for adaptation to the environment. Milder forms of these traits have thus remained unexplored and unrecorded.

It is possible that a large-scale survey of man's varied sensory traits would yield a rich harvest of data. It is also possible that we shall be able to formulate on the basis of these the lines that inheritance follows in regard to the intricate traits of man's mind. Until that consummation is reached, the survey of the sensory traits, like that presented here, serves only to raise a strong presumption in favour of the conception of psychic heredity.

§ 3. *Synaesthesia*

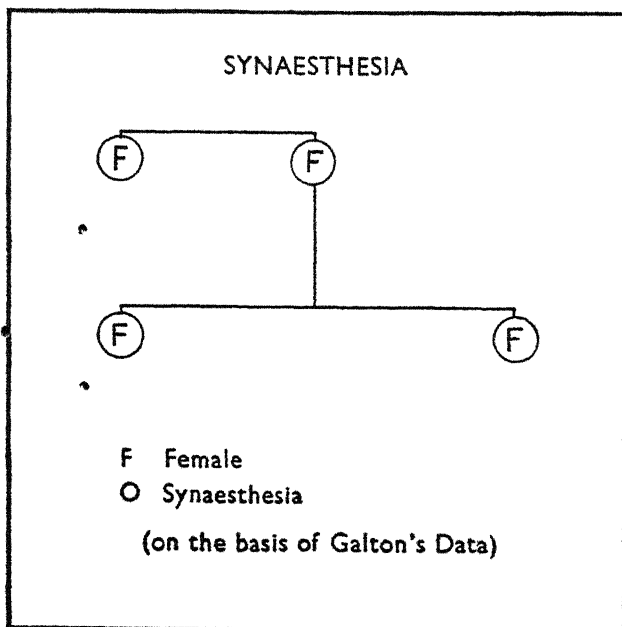
We pass on to consider a trait which is extremely rare in its distribution among the general population, but exhibits a density of distribution in certain family groups. One such trait is *synaesthesia* or *coloured hearing*. Certain sound complexes arouse in them a colour-experience more or less vivid. This does not seem to be an ordinary association factor; for, the constancy of the connection remains unimpaired with the lapse of time. I have come across only *two* cases during my long career. I have tested one of them three times in the course of four years. The colour relations remained unchanged.

The method was to produce certain tones of high pitch in Galton's whistle and to ask the person to point out the particular strand of Holmgren's wool with which the colour-experience matched. Ten to twelve colour associations out of a total of about sixteen have been found to remain identical through the lapse of time.

Galton, who studied this phenomenon first, cites several instances. One of these is represented in

Chart No. 1. He proceeds to remark, "I give this instance partly on account of the hereditary interest. I could add cases from at least three different families in which the heredity is quite as strongly marked." (9)

CHART No. 1.



One of the traits studied by Galton is the perception of what is known as number forms. There are certain persons who represent digits and their combinations in terms of geometrical forms. I myself have found one case of a person who seems to possess a phenomenal memory for numbers. I had set a series of tests for studying the capacities of this person. The tests were given in the following manner : Two digit numbers were read out to him in rapid succession, and not in the numerical sequence,—about 25 in two minutes. After the completion of the series the person could recall more than 70% of the numbers presented. The account that he gave of his performance was as follows : each number for him stimulates a visual picture, a triangle, a square, a

crescent, etc. They are also differently coloured. The process of recall takes place mainly in terms of these geometrical figures. Galton, however, speaks of number forms in another sense. The numbers for his subjects are distributed in the several points of visual space, some to the left, some to the right, etc. Each number, then, appears to have definite visual location. In some cases the scheme assumes peculiar curvilinear forms. In the case which I have investigated, I have found that a sister and a brother of the subject also appear to possess number forms of the same type. I have not enough materials to suggest whether this is a heritable trait or not. Since, however, the case resembles in many respects that of synaesthesia, it is likely that the same type of explanation will hold good.

§ 4. *Eidetic Imagery*

Fechner noticed in the sixties of the last century the phenomenon that certain images, closely resembling sensations, arose immediately after the cessation of the stimulus. He called this phenomenon *memory after-image* inasmuch as it resembled after-image in several respects. Exner in his subsequent studies noticed the same phenomenon and called it *primary memory-image*. This type of image has been brought under experimental investigation in later years by a number of workers, notably by the Jaensch brothers. They, however, coin a new name for this order of image, the *Eidetic Imagery*. The general character of the image stands midway between that of memory image and that of after-image. There are points of resemblance of this type of imagery with both of these.

Eidetic Imagery resembles the after-image in that it is projected in the space outside, that it shifts with the shifting of the point of fixation and that its space disposition is determined by that of the background. If the latter has an angle or a curvature, the *Eidetic Imagery* also shows that. It resembles memory-image in that it

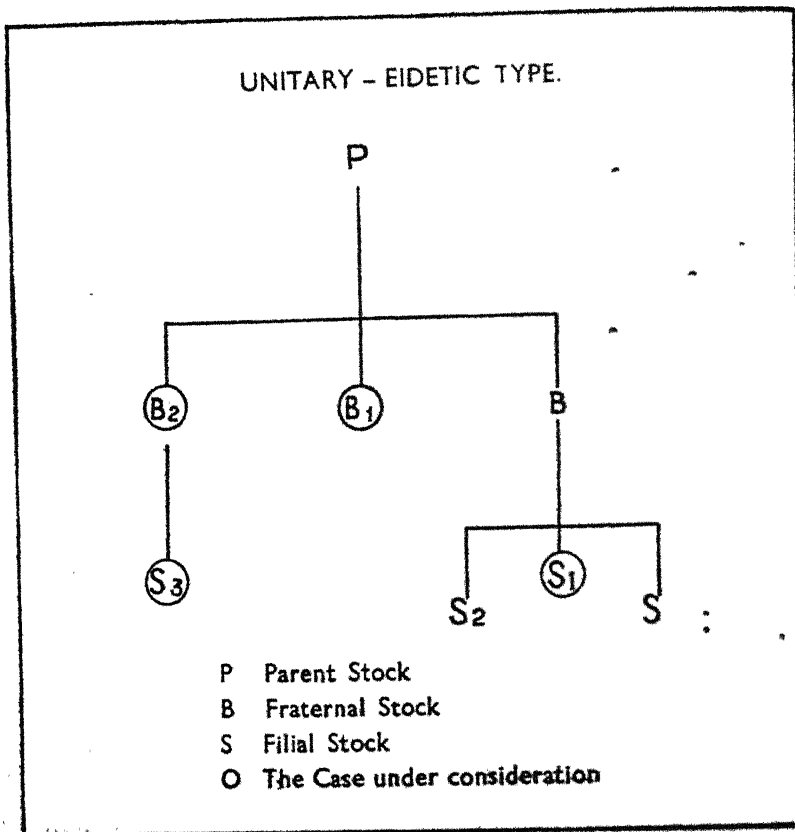
can appear long after the cessation of the stimulus ; the after-image does not arise except immediately after the removal of the stimulus. The after-image, again, is mainly of colour ; but the eidetic imagery can represent a complete scene consisting of numerous details ; in this respect then it has more resemblances with the memory-image. Lastly, the eidetic imagery can belong to several sense departments ; but the after-image is mainly visual. In this, too, the eidetic image resembles the memory image.

Normally this phenomenon is observed till the period of puberty. The vivid hallucinations and dreams are all built out of the stuff that eidetic imagery supplies. But it is not rare to find that certain individuals retain this capacity long after the onset of adolescence. I have observed in recent years the case of a student at the University of Lucknow, who was much older than the general run of graduates and under-graduates. He came to me and said that he was afraid that his mind was giving way. Upon enquiry he stated that hitherto, in the course of all his studies, he could recall vividly whatever he read with the least effort. Whole pages and chapters were, as it were, at the beck and call of his mind. For sometime, however, he had found that he could not marshall his memory in that manner. He was afraid that his mental powers were failing. He stated that his family largely consisted of men who were given to Sanskrit studies and all of them had that kind of phenomenal memory. One of his brothers was said to have mastered a book of aphorisms on Sanskrit grammar on three readings,—a remarkable performance, if true. The case in question is one of well developed eidetic imagery that has been persisting long beyond the usual years. And the description given to me of his family suggests that it is a special gift enjoyed by his family group.

One of the types of eidetic imagery is called by the Jaensch brothers *Einheitstypus* or the unity-type. In this the person confuses between the eidetic image and

the actual object. I have found in the city of Lucknow a group in which two brothers, a nephew and a first-cousin appear to possess this trait in a highly developed form. The relationship of the subjects suggests a hereditary factor.

CHART No. 2.



The susceptibility to eidetic imagery, according to Jaensch, is dependent upon "a relatively permanent, constitutionally determined factor" (10). But the constitutional factor has a large hereditary basis. It is possible, thus, to say that the eidetic image is largely a hereditary trait. Jaensch cautiously puts this idea in the following

way : "It depends to a lesser degree on a momentary, functionally determined factor."

§ 5. *Ideational Type*

Sir Francis Galton made the first precise study of mental images that appear normally in all persons, but possess an exceptionally high functional value and vividness in the mental life of certain people. The possession of these defines what is called by psychologists the *Ideational Type*. I shall try to explain the meaning of the term in brief. Galton holds that each person is limited to the use of certain types of sensory images in recalling things and situations that are not present, or in imagining the shape of things to come. In the process of recalling an absent friend, for instance, some represent his features visually ; to others his voice rings in the ear ; to a third group, there occur certain movements typical of the person ; to a fourth group, again, there occur certain verbal responses, the name of the person to be recalled and all ideas (rendered into words) associated with him. Certain other highly striking types are also found. For instance, there are certain persons who recall others by their body-odours. I had, under my observation, a student who, when presented with the linen used by five or six persons could, with a very small margin of error, give the names of the owners. This was possible when he was allowed to sniff at the trunk of the body of the persons concerned within two to three hours of the performance. Unfortunately it was not possible for me to observe any other member of this boy's family.

The problem of image type was not well-explored in the days of Galton. In fact his study is one of the earliest on this subject. He was largely under the impression that the capacity of image-representation is mainly visual in character. He says in the context of his study : "The visualising faculty is a natural gift, and, like all natural gifts has a tendency to be inherited. In this faculty, the tendency to inheritance is exceptionally

strong as I have abundant evidence to prove." The French people, according to Galton, owe their pre-eminence in various types of activities to the possession of this capacity. "The peculiar ability they show in pre-arranging ceremonials and *fêtes* of all kinds, and their undoubted genius for strategy, show that they are able to foresee effects with unusual clearness. Their phrase '*figurez-vous*' or 'picture to yourself' seems to express their dominant mode of perception. Our equivalent of 'imagine' is ambiguous." (11)

Psychologists of later years would not argue quite in this manner. They know that activities of the French people depend on a more complex system of traits than the mere power of visualising. They also know that the power of visualising is extremely common among children, primitive races as also among certain groups of people with subnormal mental ability. Besides, the visual image-type has the widest distribution of all the types. It is probably due to the fact that man uses his eyes more frequently than the other senses for the purpose of adaptation. Still, the views of Galton served to draw attention to a very important and interesting operation of the mind.

The conception of image type appeared to be a simple one to the earlier generation of psychologists. They viewed the problem very largely from the point of view of the observer, of one who noticed the trait by introspection. To him, naturally, the image appears as an irreducible and simple psychic process. An attempt at experimental exploration of the phenomenon, however, reveals a situation of considerable complexity.

The methods of determining the image type are based on three different principles : (a) In the first place, the image that appears *first* in recall is said to define the type of the individual. For instance, if in remembering the past events the visual picture of the incidents appears before any other mode of experience, the person in question is said to belong to the visual type. *Primacy* in the order of the appearance of the image, then, is the first

principle in the definition of the type. (b) The second principle is that of *frequency*. The imagery which is employed more frequently in recalling the events that are not immediately present, defines the type. (iii) In the third place, the imagery which is employed when *the recall is difficult* or complex defines the image type. These experiments show that the process of recall is exceedingly complex and often variable. A person may use several kinds of imagery, visual, verbal and kinaesthetic, in representing the same situation. The order of their appearance, again, may not be constant. The value of variation is often very large even under favourable experimental conditions. Thus, it is very difficult to base any conclusion upon the phenomenon of ideational type. The similarities and differences between the siblings may be explained as falling within the normal range of variations. They might also in some measure be attributed to the common features of the environment and common modes of adaptation to them.

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CHAPTER III

INHERITANCE OF PATHOLOGICAL TRAITS.

§ 1. *Prefatory Remarks*

Man's mental life exhibits a high degree of variability. It is probably the most variable reality known to us. It is more difficult then to attribute any particular mental function to hereditary factors than to interpret it in terms of social and physical environment or nurture. It is not surprising to find, therefore, a sharp divergence of views concerning the relative significance of nature, nurture and environment in the causation of abnormal mental traits.

Yet, the discovery of the trait to be studied becomes easier in the case of pathological functions. Man's attention is normally drawn to what is unusual and strange. The more a person deviates from the norm of the group the more is the chance of the person being singled out for admiration or censure by his fellow men. The study of heredity of the mentally abnormal, therefore, becomes relatively easier than the study of normal traits which we have surveyed in the previous chapter.

The danger in the study of the abnormal is the rush of too much material, too many details being placed in the wrong perspective. An old Quaker said to his friend : "Every one is mad but me and thee ; and I have suspicions even of thee." On the surface then there would be a surfeit of data ; upon analysis much of it would melt into fiction and tall stories.

There is another caution which is necessary to remember in tracing the heredity of abnormal persons. The trait that appears in the form A in one generation may appear in the form B in the next or in the previous one.

A paranoid may have a dissolute person for his father, a drunkard for his grandfather and a shiftless youth for his son. It is necessary to look behind the symptom-complex in this field and to focus upon the personality trends and the psycho-physical traits that underlie the neurotic transformation. A survey of neurosis in the manner of a census, unguided by psychological insight, is useless. These general remarks will be instanced by the materials that will be presented in the course of this chapter.

Lastly, the incidence of a trait or trait-complex need not necessarily be found in the direct line or among the immediate ancestors in the direct line. The mental malformation may appear in an intense form among the collaterals, among aunts, nephews and nieces. A family should almost literally be visualised as a tree that has branched out. The incidence of a trait in one or more branches raises a presumption of its presence in a latent form in many individuals of the family.

§ 2. *Chronic Drunkenness, Psychasthenia and Hysteria*

I shall deal with certain milder types of disorder which often pass unnoticed and are not regarded as true disorders but as moral or intellectual defects. The instance of chronic drunkenness is in point. A study of the family of chronic drunkards yields the conclusion that there is an incidence of various types of abnormality especially among the nephews and children of these persons. Brugger has reported a study of this nature the compass of which included the children, nephews, nieces and grandchildren of those possessing this trait. The nephews and the children seem to be affected more intensely. It is to be noted that they are not necessarily drunkards. The taint may express itself in many forms (1).

The chronic tendency to drunkenness is popularly regarded as a causal factor that induces various types of disorders among the descendants. We are now coming to look upon it as an *effect* of a neurotic trait which can

be traced far into the line of ancestors and which trails down among the descendants, affecting them with varied symptom patterns. This trait and in fact chronic vice of any description indicate a persistent state of irritation, mental and sometimes organic. The special kind of indulgence that man seeks for relieving the inner tension depends upon his training and environment. The same organic and mental condition may, then, lead to a variety of behavioural expressions. Yet, most of these lead to what may be subsumed under the comprehensive term 'social rottenness'. Hence, an inebriate, a licentious person, a 'slacker' in business who takes to dishonest pursuits and a gambler, may all represent the same brand of the 'waster' under the threefold conditions of nature, nurture and environment.

I shall now turn to a second category of disorder which too receives but little serious notice in the context of our usual social life. Janet, the great French neurologist, has defined a special group of symptoms, those of anxiety, feeling of unreality of things, obsessions, impulsions, feelings of failure and inadequacy, perpetual doubt and incapacity to reach decisions, as *psychasthenia* (2). The psychasthenic may be regarded as a person tending towards insanity but not yet in that category. The last generation of psychiatrists attribute this condition to heredity. It is said to be due to "constitutional factors" which in their turn are inherited. A study of these patients, published a few years ago, seems to suggest that we have not outgrown the old theory. The relatives of 890 patients suffering from psychasthenia were brought under study and observation. It was found that 1648 of them suffered from the disease. This is far too large a number to be explained satisfactorily on any principle other than that of heredity (3).

Another study, of a more general character, seems to confirm this conclusion. Himm traced the relations of 225 members of the public and came to the conclusion that the closer the degree of genetic relationship with a mentally diseased person, the greater the chance of the

occurrence of a mental disorder. The author was fortunate enough to discover 214 pairs of twins, 76 of them were "identical" or monozygotic twins. Among these latter, the occurrence of disorder in one member was correlated with the disorder in the other member of the pair in 93% of the cases. Among the ordinary siblings, the disorder in one member corresponded with that in another member to the extent of 17%. It was further found that the incidence of disorder among the male relatives of the patient was higher than among the female relatives (4).

These facts point unerringly to the influence of heredity. There is, we know, a likelihood of discovering a greater degree of resemblance between any person and his relatives in the matter of physical features. In a similar way, there is a greater chance of resemblance in regard to a neurotic taint between any person and his blood relations. The taint, however, as we have noted above, need not manifest itself in the form of the same neurotic *trait*. The record given above serves to distinguish the relatives of the asylum population merely by their tendency to manifest *some* form of neurosis, not necessarily that disorder from which the patient suffers.

In fact many workers in this field of study are inclined to postulate the inheritance of a disposition to the disease, an *Anlage*, rather than of a specific symptom complex. For instance, Kraulis who has studied the family history of 106 probationers suffering from hysteria at the Munich Psychiatric Clinic, suggests that there is a special hysterical *Anlage* which is inherited and which underlies all hysterical reactions (5).

I have studied a Bengal family and its siblings with a great deal of care. I have found fourteen persons out of a possible thirtytwo, subject to various types of mental disorder, ranging from uncontrollable temper to dementia and vagrancy. One is an actual suicide and several have either attempted or persistently threatened suicide. Many of the siblings are of the sub-scholastic type mainly due to emotional maladjustment and a

tendency to wander about. Such a family group can be explained only on the assumption of a *neurotic-Anlage* and not on the basis of the hypothesis of inheritance of a neurotic symptom-complex.

CHART No. 3.

G I	Nothing reliably known.
G II	Three individuals, two men and a woman known. All three of violent temper, socially and vocationally maladapted though intellectually competent and even brilliant. The men are G II (1), G II (2) and the woman G II (3).
G II (1) w	wife of G II (1)—emotionally unstable.
G II (2) w	wife of G II (2) presents an interesting case. She was suggestible, of violent temper and emotionally unstable. One of her brothers is a vagrant. A son of another brother a lunatic. One of two sisters known to be of a violent temper.
G III (a)	Children of G II (1)—One son a lunatic of manic-depressive type. One son socially maladjusted. Two daughters of violent temper. Nothing known about the children of this generation.
G III (b)	Children of G II (2) and G II (2) w—Two sons and four daughters. One son socially and vocationally maladjusted though intellectually normal. One son intellectually dull but otherwise normal. All the four daughters are of violent temper and are disturbing elements in the family.
G III (c)	Children of G II (3)—Two daughters one like G III (b).
G IV (b)	Children of G III (b)—Seven children—four sons, three daughters. One son definitely cycloid type ; socially and vocationally maladjusted but intellectually normal ; subject to delusions. Two sons scholastically subnormal, one probably a moron. All the daughters are as G III (b) and subject to delusions of grandeur, reference and persecution.
G IV (c)	Children of G III (c)—One is a suicide. One is scholastically subnormal. One a swindler.
G V (b)	Children of G IV (b)—All subject to tantrums. Not old enough to exhibit other symptoms. None older than 12 years.

§ 3. *Epilepsy*

The same principle is brought out if we analyse the data obtained from the survey of the families of epileptics. The following tables give the results :

TABLE I.

A Study of 531 Children of Epileptics :

Normal	..	..	105
Epileptic	..	..	78
Insane	..	..	11
Ament	..	..	18
Died young	..	..	222
Rest not known.			

TABLE II.

A Study of 432 Children of Epileptics :

Epileptics	..	..	14
Insane	..	..	2
Ament	..	..	14
Died young	..	..	151
Rest not known.			

The traits that appear in the offspring are not limited only to those appearing in the parent stock (6). Yet, the epilepsy syndrome is of a fairly strong heritable character. The disease which occurs in Germany at .3% among the general population has an incidence of about 10% among the siblings of the epileptics (7). A relation of the epileptic has thus 30 times more risk of suffering from the disease than any member of the general public. The disorder, however, need not be limited to epilepsy alone. It is quite common to discover among the blood-relations of epileptics a wide prevalence of delusion-symptoms, melancholia and hysteria. These again shade into degrees, from their intensive states to milder forms. The latter disorders, however, are often neglected in social surveys, partly because they are treated as eccentricities,

and partly because the investigator, in his desire to be free from subjective bias, views them as eccentricities rather than as pathological characteristics. We are thus led to conclude that several of these mental diseases are inherited as such and also in the shape of other disease-traits.

§ 4. *Manic-Depressive Insanity*

Heredity seems to be an effective factor in the genesis of Manic-Depressive psychosis. It is a mental disorder in which the patient oscillates between the two extremes of excitement and depression. At one phase the patient is boisterous with joy ; he bursts into sudden passion, and talks and moves excitedly. The other phase exhibits itself in the shape of depression and melancholy. Several careful investigators have come to the conclusion that the disease is strongly heritable. Luxenberger finds that 10% of the siblings of the patients' family are subject to the disease. Rudin, however, finds that when one parent and one offspring suffer from this disorder, about 24.6% of the siblings suffer in the same way. The incidence of the disease among the nephews and nieces is three times as much as among the normal population.

Whatever the intensity of the trait may be, the facts suggest that the factor of heredity is important. The fact that the nephews of the cycloids are subject to the affection three times as much as any member of the general public, indicates the operation of hereditary factors. Uncles and nephews do not usually live together among the people studied by the authors referred to above. The factors of social influence and imitation, then, are to be discounted. Heredity remains as the residual explanatory principle.

§ 5. *Inheritance of Schizophrenia*

Schizophrenia that causes a profound disturbance in the whole scheme of personality, seems to extend its in-

fluence across generations and reach out to distant descendants. It is found for instance that 5% of siblings, 2% of grandchildren and 1.4% of nephews and nieces of schizophrenics may be subject to the disease (8). It was found that 8.6 to 10% of the parents, of the 150 patients studied, were subject to the disease. In the case of identical twins, in ten out of twelve pairs both the members suffered. In the study that Legras carried on in Holland both members of the six pairs of twins were subject to the disorder. The general conclusion of this line of study, then, is that schizophrenia chases its victims through several generations and tends to spread over the different branches of a family. We may present the result of these lines of study in the tabular form in the following way (9) :

TABLE III.

Inheritable Mental Diseases in the Family of the Patient:

Patients.	Siblings.	Grandchildren	Nephews and Nieces.
Schizophrenia	5%	2%	1.4%
Manic-Depressive Psychosis	10%		About 8 times as many as in normal population.
• Epilepsy	10%		
Hysteria	13%		

The data cited above do not, however, represent the total ravage of the malady. It has been stated in a previous section that a neurotic trait may reproduce itself in many different forms. This is true of schizophrenia as of other mental disorders. Here is the record of a family in which the parents, so far as I know, were normal. The father was in business and carried on his duties successfully. Nothing seems to have been wrong with the mother, except violent fits of temper. Of three children, one son and two daughters, the former seems

to be a patient of what is known as schizophrenia of the 'simple' type. One of the sisters is subject to delusions and has been exhibiting a definite, paranoid tendency: The other sister is subject to hysterical fits. The root of schizophrenia, too, then lies in some kind of an *Anlage* that may exhibit itself in various alternative forms. It is not possible to say what exactly a relation of a schizophrenic would suffer from. It is, however, suggested by the facts cited here that such a relation has a greater chance of developing a mental disorder in some form than a member of the general public.

It is possible to envisage the psycho-physical root of mental disorders in the following manner: The medical sciences speak of a condition of general constitutional debility. They also speak of growth or loss of immunity to a particular disease. The neurotic disorders seem to be rooted in a psycho-physical condition that involves the *loss of a specific immunity and the growth of a general type of debility*. The former accounts for the fact that the blood relations of the patient exhibit a heightened susceptibility to the disease in question. The latter factor explains the increased incidence of other types of disorders among the siblings.

The simultaneous appearance of these two tendencies makes the individual more susceptible to the stimuli of the environment. Social and physical factors more readily disturb the balance of the psycho-physical system. We may think of this disturbance as a breakdown of what Head calls the "*vigilance*" systems. The nicely balanced schemes of behaviour are interrupted to the extent that 'vigilance' is disturbed. And adjustments to the environment, social, familial and vocational, are more or less seriously impaired.

The concept of vigilance and that of its disturbance by the stimulus factors represent the interplay of organic functions in the milieu of stimulus-patterns that daily life gives. It is reasonable to suppose that there is a heritable basis for the organic functions and the manner of the scheme they build. But it is not possible at the

present stage of our knowledge to define these in a precise manner.

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CHAPTER IV

INHERITANCE OF INTELLECTUAL 'DULLNESS' AND 'SUBNORMAL' ABILITY.

§ 1. *Introductory*

We have surveyed in the preceding chapter a number of pathological traits rooted in inheritance. Each of these traits brings with it a number of symptoms that render particular types of adaptation difficult, if not impossible. There is, however, another kind of disability that shades into the pathological, and represents a general diminution of several abilities needed for adaptation to the common situations of daily life.

Such lowering in the level of the personality is so gradual that it passes unnoticed in its milder forms. This often leads to failure in an environment that calls for a nicely balanced reaction. A failure of this type, however, usually passes unnoticed or is explained away in terms of one or other accidental factor. A study of heredity spreading over several generations, sometimes reveals a progressive increase in the degree and range of maladjustment. It is then only that attention is drawn, but too late, to the early beginnings.

The genetics of low-level personality which would be of great social interest is thus obscured by the difficulties in the method of study. The stage when attention is drawn to the phenomenon, adventitious factors have already played their part. Social and vocational success and failure have concealed the profile of natural abilities. The social estimate, upon which we have drawn in order to arrive at an understanding of a personality which is no longer available for direct observation, has rendered the personality-data useless for the purposes of scientific generalisation.

Yet, it is not altogether impossible to study the inheritance of milder forms of low level personality. There are, in well ordered societies, institutions to which individuals have to adjust themselves. School and factory, home and social situations, jail and army, are some of these. It is possible to have access either to records or to other types of authentic information, in regard to success or failure in these institutions of persons belonging to particular family groups. These might throw light on the question of inheritance.

Another method would be to carry on regional surveys of children. When a child is found to be defective, as many of his blood-relations as can be found, may be interviewed. In this manner an estimate of the personality-level of these persons can be formed. Such estimates should be made by persons used to dealing with the problem of abilities. Businessmen, experienced teachers, psychologists and medical men may be entrusted with this task. A relation may thus be discovered between the estimate of the mental-level of the family arrived at in this way, and the mental level of the child. The estimate of the mental level of the family must be with respect to the number of persons affected as also in regard to the degree of affection. These methods would reveal data of sufficient importance for the purposes of genetics.

§ 2. *Dullness and Retardation as based on Heritable Traits*

The problems of mental dullness and retardation may be approached by a study of the over-age children. The school system of every country expects children of particular age-levels to belong to specified grades of the school. The mental ability of those above and below the age-level may be ascertained. The study may be followed by interviews and examination of the scholastic and other available records of as many members of the family as possible. A scrutiny of such data would throw light on the question of inheritance,

The following table gives the data of a regional survey of the type indicated above (1) :

TABLE I.

The Result of a Regional School Survey :

Total Population	..	..	45,435
School Population	..	..	6,645
<hr/>			
7.3%	of school children above 8 years. Retarded by 3½ years.		
30%	of school children above 8 years. Retarded by 2 years.		
77%	of these retarded children are also <i>dull</i> .		
12%	Retarded .. a/c want of facilities.		
3%	Medical reasons.		
75%	of the defectives come from defective stock.		
25%	No definite cause.		

A similar method is represented by the study of siblings and unrelated children under the uniform environment of the orphanage. Such studies have been suggested and undertaken by eminent authorities such as Karl Pearson and Carr-Saunders. The studies of Gertrude Hildreth and Kate Gordon in this field are also well-known (2). The method consists in the main, so far as the problem of this chapter is concerned, in the following : The Intelligent Quotients of siblings and of unrelated children in an orphanage are computed on the basis of a selected scale. The coefficients of correlation of the I.Q. of the sibling groups and of the unrelated groups are worked out. The environment of the orphanage being the same for both the groups, a higher coefficient of correlation among the siblings indicates the operation of heritable factors. The I.Q. of most of the inmates tested by the Haggerty and Dearborn scales is below 90. Most of the children, therefore, may be regarded as belonging to the category "*dull*". Inheritance of this trait, therefore, would prove the inheritance of dullness.

The following tables give the I.Q.-values and the coefficient of correlation (r) mentioned above :

TABLE II

Siblings

Years in Orphanage. Years Months	I.Q.	No. of Cases.	C.A.
0 — 3	86.39	294	12.7
4 — 6	86.40	164	13.6
7 — 9	85.95	108	14.5

TABLE III

Unrelated Children :

Years in Orphanage. Years Months	I.Q.	No. of Cases.	C.A.
0 — 3	86.05	294	12.8
4 — 6	84.2	164	13.5
7 — 9	84.59	108	14.4

A comparison of children of such mental equipment is instituted among siblings and among unrelated children. The following table indicates the results :

TABLE IV.

Institutions.	Tests	r	No. of Pairs.
a	D	.38	106
	H	.55	
b	D	.54	94
	H	.41	
c	D	.24	62
	H	.17	
d	D	.41	19
	H	.18	
e	D	.33	24
	H	.15	
f	D	.40	15
	H	.30	
Unrelated Children in Orphanage.	D	.033	100
	H	.034	

C.A.=Chronological Age ; D=Dearborn Scale ; H=Haggerty Scale.

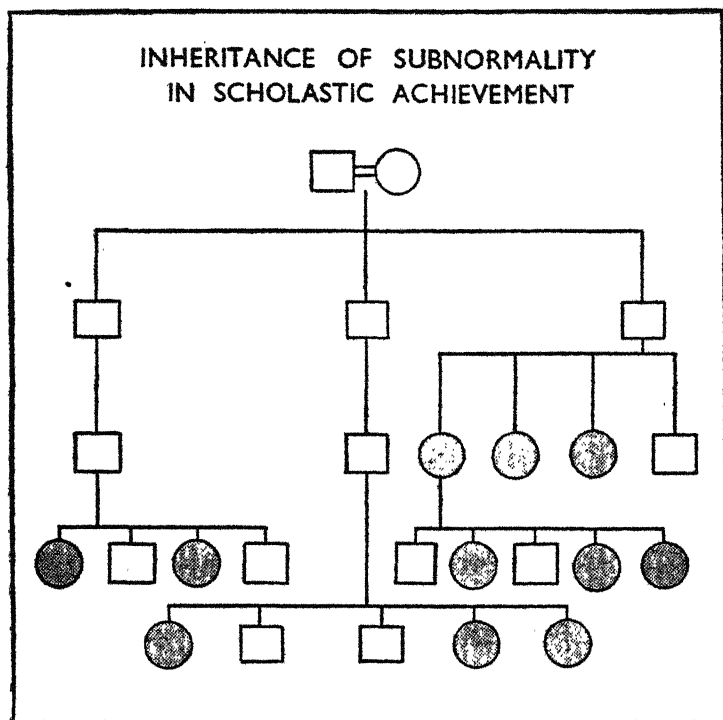
The above tables show that there is a much higher degree of correspondence between the siblings than among the unrelated children in the orphanage. The author cautiously concludes : "The actual mental resemblance between siblings would appear to indicate the force of heredity rather than conditions of environment." (3)

A low grade ability in regard to adjustment in school seems also to have a hereditary basis. Such adjustment is not entirely intellectual. It implicates a certain type of social orientation, a capacity to fit in with the new routine of life, and also an ability to control and stimulate one's own interests in things that do not carry an immediate appeal. If a large number of the members of a family fails to get on with the routine in school for several

generations, without any specific environmental factor to explain the phenomenon, we should expect a heritable trait at the basis of failure.

Steggerde presents a pedigree to show a lack of scholastic interest. It is found that 13 out of 14 issues in the second generation, and 6 out of 23 in the third generation in a family have left school early, due to incapacity to adaptation (4). I have collected the record of a family in Bengal in which eleven out of a possible twelve of male offspring were compelled to abandon the scholastic career at the primary stage. The three branches of the family are traced to a common ancestry through the female line which alone is shown in the pedigree chart. There is no reliable evidence in regard to the scholastic abilities of the females. The chart, therefore, makes no

CHART No. 4.



attempt to represent this fact. The squares represent the females and the circles the males. The shaded circles represent subnormality.

A number of case-studies representing the mental status in relation to the ability-level of parents is given in the following table (5) :

TABLE V.

Matings of Parents	Character of Offspring		
	Normal	Dull	Mentally Deficient
Superior + Superior (45)	126	13	49
Superior + Dull (18)	36	20	24
Superior + Deficient (12)	11	14	20
Dull + Dull (9)	8	12	17
Dull + Deficient (9)	0	1	12
Dull + Deficient (7)	1	3	18

It will thus be seen that there is a definite relation between the ability level of parents and that of offspring. It is not possible to specify the character of the genetic factor or to isolate the unit character involved in these cases. The question of inheritance is not ruled out of court for that reason. On the contrary, the facts suggest that low-level ability-profiles are induced more often by inheritance.

Such a conclusion has an important practical significance. It is found, especially in India, that persons with a small equipment of intellectual and other abilities, are ushered into the field of university education by a process of intensive coaching and special preparation. Many of them lead a low-level intellectual existence and are finally turned out none the better for their 'higher' education. They acquire special vocabularies in several subjects. But they gain neither an insight into these nor an increased sense of orientation to the cultural and vocational situation.

It is quite possible to direct these persons to vocational and cultural institutions more consonant with their equip-

ment of abilities. This is often done on account of such extraneous factors as inadequacy of finance ; there should not be any objection to taking the same step on account of inadequacy of abilities. To give a specific direction to education due to pecuniary insufficiency is rooted in social injustice. To do so on the ground of insufficient ability is the height of social justice.

But it is not suggested that any one who is found to have a low-level ability at a certain stage of school life should be shunted off to a narrow groove of training which leaves him but little chance of self-improvement. The idea is that pupils with a low-level and small range of abilities should be specially observed. If it be found that there is a large number of members of the family with similar records of ability, it would be reasonable to infer that hereditary factors are responsible for the inadequacies exhibited by the pupil. It would be then very reasonable to place him in an environment more in keeping with his abilities. His labours that prove inadequate in the usual scheme of studies, may yield better results and may thus bring a greater sense of success and mastery.

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CHAPTER V.

INHERITANCE OF AMENTIA.

§ 1. *Definition and General Character*

Tredgold defines amentia as a "state of restricted potentially for, or arrest of cerebral development, in consequence of which the person affected is incapable at maturity of so adapting himself to the environment, or to the requirements of the community, as to maintain existence independently of external support" (1). Such adaptation, however, is capable of variation by degrees. We should, therefore, expect that aments should be capable of classification into several grades in proportion to the intensity of the disorder.

There are, generally speaking, three main grades of amentia, high, medium and low, in the descending order of ability. The Mental Deficiency Act of 1913 in Great Britain defines high grade amentia in the following way : "Persons in whose case there exists from birth or from an early age mental defectiveness not amounting to imbecility, yet so pronounced that they require care, supervision, and control for their own protection or for the protection of others, or, in the case of children, that they, by reason of such defectiveness, appear to be permanently incapable of receiving proper benefit from the instruction in ordinary schools." These persons are called *Feeble-minded* or *Moron*. The former term, however, is often employed as equivalent to the term ament.

Morons are capable of carrying on fairly complicated items of work. They can run simple types of machinery and can take care of animals with occasional or no supervision. Though they cannot get along with the routine

of ordinary schools, they can be given training in special schools suited to their mental level.

Medium grade mental deficiency or imbecility is defined in the following way : "Persons in whose case there exists from birth or from an early age mental defectiveness not amounting to idiocy, yet so pronounced that they are incapable of managing themselves, or their affairs, or, in the case of children, of being taught to do so." These persons can carry on such stereotyped work as sweeping the yard or the floor, weeding the garden or washing, with some degree of supervision.

Low-grade amentia or idiocy is defined in the following way : "Persons so deeply defective in mind from birth or from an early age, as to be unable to guard themselves against common physical dangers." Tredgold divides idiocy into two grades : *Partial and Complete*. The members of the former group can discriminate their principal instinctive urges such as those of hunger and thirst, and can be taught certain measures of personal cleanliness. The latter are incapable of being guided by these primitive urges in their behaviour, or of being trained in the methods of keeping the body clean.

Amentia may, again, be *primary* or *secondary*. The former consists of "a defective germ plasm" so that there is an arrest and irregularity in the development of the nervous system. In the latter, "the growth of a portion of the brain is interfered with or arrested by disease or other adverse environment." The former is due to inherited factors. For, the germ plasm is not supposed to be so affected by the environment as to transmit a disease-trait from one generation to another. All the primary forms of amentia, therefore, are traced to heredity.

The heritable trait, however, does not exhibit itself as *amentia* in all the generations. In one generation it may appear as a general irritability, maladjustment and tension of the personality seeking release in drunkenness and debauchery. Such excesses leave a legacy of debility and

venereal diseases which are often regarded as *causes* of primary amentia. The truth, however, is that they are only parallel symptoms. In one generation, thus, the factors of maladjustment seem to be moral defects. In another generation they manifest themselves as amentia. The pathological trait exhibits itself in the shape of various forms of a neurosis. It is epilepsy in one instance ; one or more types of mental disease, schizophrenia, manic-depressive insanity and paranoia in others ; or even mere 'hobo'-ism and shiftlessness in still other cases. Thus, it is not necessary to look only for amentia in the family-tree of the ament. The heritable trait may have assumed any one of the many variable forms of mental disorder (2).

§ 2. *Heredity Factor in Amentia as revealed by Social Survey*

Amentia is the best studied of all the neuropathic traits. The incidence of the trait has been surveyed statistically. Many family histories have been collected. Pedigree charts have been drawn with care, to show the pattern of inheritance.

The best way to approach the problem of amentia is to pursue the family history of the inmates of an asylum. It is, however, often necessary to explore the field by a general survey of the school-going population of a region. In India where practically no well-established institute for the ament exists, it will be necessary to begin with several regional surveys of the type indicated by Table I of the preceding chapter.

A survey of this nature may begin with the over-age children in the lower classes of middle-vernacular and primary schools. Repeated failure of pupils in their studies, would naturally draw the attention of teachers to these cases. Awkwardness in movement, defects of speech, social maladjustment and low efficiency at games and other activities of the age-group, would hold the per-

sonality of these in high relief. A regional survey of these pupils in districts and provinces would exhibit the operation of specific causal factors such as prevalence of diseases like malaria and the demand on the pupils' time for rendering help at home. It would also give an opportunity to trace the family-tree of these pupils so that the incidence of neurotic symptoms may be ascertained.

It is found in the type of survey referred to above that 77% of these retarded or over-age children are also dull. I have tried to follow up in recent years a small number, viz., 13 cases of over-age children marked by a general dullness of demeanour. The following table gives a record of their family. Judgments about brothers, younger sisters, cousins and fathers could be obtained :

TABLE I.

<i>Father</i>	(i)	Dull and shiftless	3 cases
	(ii)	Drunkard	2 cases
	(iii)	Violent temper and suspected licentiousness	1 case
	(iv)	Rest	No report of abnormality.
<i>Brothers & Sisters :</i>	(i)	All of three dull in studies	1 case
	(ii)	2 out of 3 or more dull	5 cases
	(iii)	1 out of 3 epileptic	1 case
	(iv)	1 out of 3 suspected amentia	1 case
<i>Cousins</i>	(i)	6 scholastic dullness.	
	(ii)	5 general dullness (maternal uncle's children).	
	(iii)	3 epilepsy—(maternal aunt's children).	

There are far too many instances of abnormality and sub-normality in these cases. The feature to which attention should specially be drawn is the incidence of pathological traits on the maternal side. The reason is not far to seek. In the cases of arranged matches that prevail in India and due to the general ignorance of facts of mental genetics, no attention is paid to any member of the family other than the bride and possibly her brothers

and sisters. Even if one notices dullness or abnormality in the case of cousins, the fact is overlooked. It is easy, in these conditions, for persons with recessive pathological traits, and sometimes even with a dominant one, to be married into healthy families. Thus amentia makes its unexpected appearance even in families with fine records of achievement.

Another study of the same type finds that the percentage of amentia among the brothers and sisters of the aments is 23%. If, however, we consider the population at large, the percentage is about 6%. One of the workers gives statistics to show that there is a greater frequency of the trait among the male. Hence he concludes that it is a sex-linked character (3).

§ 3. *The Pedigree of Amentia* .

The survey of pedigrees serves to bring out clearly the rôle of heredity with respect to amentia. The Jukes family and the Zero family, the Kallikak family and the Nam family are the classical studies on this subject. I shall give a summary of some of these data :

(i) *Jukes Family* :

The history of this family has for its setting the State of New York. The family traces itself from the five daughters of a fisherman born in 1720. Altogether 1200 members of this family have been traced. Of these, 300 died in infancy. 310 were professional paupers living in alms-houses. 440 were physical wrecks due to wicked living. More than half the women were prostitutes. 130 were convicted criminals. 60 were convicted thieves. 7 were murderers. Not one had a common school education. 20 learnt a trade and 10 of them learnt it in a state prison (4).

(ii) *Zero Family* :

The family is of Swiss nationality and divided into three main branches two of which remain highly respectable while the third abounds in cases of amentia, social degeneracy and criminality. Jorger has excavated out of social oblivion a fairly complete record of this family.

The pathological branch was founded by a man of roving disposition who married a vagrant Italian woman. Their son married into a German vagabond family named Marceus. All the seven children of this couple were characterised by vagabondage, criminality, drunkenness and mental deficiency.

A priest attempted to save some of the children of this branch in 1861, by placing them in respectable homes. All the children gradually ran away from their better surroundings to their depraved family. A record of 134 members of the family in the sixth generation shows the following distribution :

TABLE II.

Vagabonds	..	..	8
Illegitimate	..	..	41
Lewd and Drunkard	..	..	5
Ament	..	..	29
Criminal	..	..	4
Early death	..	..	30
Not known	..	..	17

(iii) *Nam Family* :

This family descended from one Joseph 'Nam', born about 1760 in Massachusetts. 784 descendants of the family have been traced. A very large percentage of these are

chronic alcoholics ; Davenport and Estabrook put the percentage at 88 for females and 90 for males. There were 232 licentious women and 199 licentious men as against 155 women and 83 men living a normal social life. 19 were epileptics, and 24 insane. 40 of them have been in prison. A glorious record of degeneration ! (5)

(iv) *Kallikak Family :*

The most interesting of these surveys is that by Goddard of the "Kallikak" family. The main interest lies in showing how two different strands of character arise from two matings of the same person. One Martin Kallikak, a normal person, married a normal woman in 1837. 496 descendants of this couple have been traced for several generations by Goddard and have been found to be normal according to the ordinary standard. But Martin Kallikak had a child by a feeble-minded girl. This line of the family numbering 480, too, was living in the same region and in the same social environment. Yet more than 200 of this line were positively suffering from amentia. This case clearly brings out the hereditary factor in amentia (6).

§ 4. *Hereditary Factors in Amentia*

The heredity of amentia, from the very nature of the case, not only trails down to the descendants but also leads us up among the ancestors of the tainted family revealing deep-seated pathological features. The following table compiled from the literature on the subject given the percentage worked out by several workers in different countries :

TABLE III.

*Percentage of Neuropathic Heredity in Primary
Amentia :*

Investigator	Country	Percentage
Shuttleworth	England	41.38
Caldecott	England	70
Koch	Germany	60
	Switzerland (1893)	55
Dahl	Norway	50
Tredgold	England	82.5

Tredgold's study has covered from three to four generations of ancestors. He explains the lower percentage obtained by others on the basis of the number of traits selected for examination. If a limited number of traits be selected for study, fewer persons would be found to possess them singly or collectively. A larger number of traits would in the same way show a wider distribution, singly or in groups. Again, no one wishes to parade a pathological trait of his ancestors. The investigator must win the confidence of the people concerned before he can have any reliable information. Extensive studies carried on in the United States in regard to the intricate family relationships that connect the best families with the worst, has led to the following generalisation: "According to a recent calculation about one third of the population in the United States is thus capable of conveying mental deficiency, the 'insane tendency', or some other defect" (7). Even a large percentage of normal population would in this way have neuropathic inheritance.

The problem of inheritance of mental traits, then, is not a mere theoretic problem for Psychology or for Genetics. It raises far-reaching issues touching upon the larger social policies of the race. Davenport's study of the history of the "Hill Folk" vividly illustrates the

danger of a policy of *laissez-faire* in this matter. "In the neighbourhood of a small town lying among the New England Hills there is a population" says Tredgold in summarising this study, "among which feeble-mindedness, alcoholism and immorality are rife. It was found that practically all the less desirable inhabitants could be traced back to one of two original sources—a shiftless basketmaker probably of French origin and an Englishman, both of whom migrated in the district about the year 1800." It was found that between 1879 and 1889 they absorbed almost $1/10$ th of the total poor relief fund of the district. The proportion has increased to $1/4$ th. 16 of these descendants have been convicted during the past 30 years for serious offences, mostly of a sexual character. Such reports make gloomy reading ! (8)

§ 5. *Conclusions from these Studies*

Goddard who has studied more than 300 of such families concludes that feeble-mindedness or amentia is hereditary and is transmitted from one generation to another like any other trait. He further suggests that amentia in its general form is a *Mendelian Recessive character*. Thus, the trait would lie latent in the personality make up of the individual. Many a person would in this way carry forward the taint without exhibiting any stigma himself or herself (9).

I shall close this study by summarising the conclusions based on the Mendelian hypothesis, as set forth by Shuttleworth and Potts :

- (i) In the case of both normal parents the children are expected to be normal. They will not in such cases be the medium of transmission of a diseased trait.
- (ii) If a normal person whose family is quite free, marries either a mentally defective person or one who, though normal, is a carrier of the

defect, then, although all the children will be normal, a certain number will be carriers of the taint.

- (iii) If the second parent is actually defective, half the children will carry it.
- (iv) If the second parent be merely a carrier, that is to say, if the trait be recessive, only one in four of the children will *carry* the trait in its germ-cell.
- (v) If both parents are apparently normal, and yet both carry the taint, then, *one in every four* of their children will be defective. In addition, *two out of every three* of the normal children will carry the defect while only one will be entirely free.
- (vi) If both parents are defective, every one of the children will be defective. (10)

In spite of such assured conclusions, it is not possible to find an exact numerical correspondence between the theory and the pedigrees so far collected. One reason suggested by the authors referred to above is that "the results of Mendelian inheritance can only be exact when the families are large, as in the vegetable kingdom." Goddard's conclusions approximate to the general formula for Mendelian recessive traits.

The Mental Deficiency Act of 1913 in Great Britain takes partial cognisance of these data of heredity although much remains to be done. The Act provides that any person having sex-relations with a mentally deficient person who has been brought within the cognisance of the Board of Guardians appointed for the purpose, will be legally punishable. But this is hardly sufficient for the purpose of ensuring a wholesome population policy.

The Mental Deficiency Act of the State of Indiana, U.S.A., passed in 1907, and of the State of Connecticut, U.S.A., passed in 1909, represent a more progressive biological and psychological outlook. The former provides that "it will be lawful for the surgeons to perform such operation for the prevention of procreation as shall be

decided the safest and the most effective." The Act of Connecticut too has similar provisions. (11)

We in India are very far from the formulation of any social or state programme in this matter. It is customary for people to conceal the facts of mental defects and to give their sons and daughters in marriage, paving the way for the birth of a long line of miserable and maimed minds. One such creature is the potential progenitor of hundreds and the danger is enhanced by the fact that these creatures are prolific. Social neglect of the problem opens the way for the flooding of the healthy population by sub-cultural men and women who breed defectives and open the way for vice at every angle of social life.

The only silver lining in the cloud is that the children of these families have a tendency to die young. It is an escape both for them and society. But once they elude the vigilant eyes of the natural forces, they have a way of propagating in large numbers. There arises for the society in the course of time, the problem of a large sub-cultural class which holds it back from effective orientation for economic and political purposes. Mental deficiency is a problem for the psychologist ; it is a problem for the biologist. But above all, it is a problem for the state.

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CHAPTER VI

INHERITANCE OF TALENTS AND ABILITIES.

§ 1. *Introduction*

I have presented so far the data concerning the inheritance of certain peculiar traits and certain dispositions that mature into diseased minds in the siblings. The foregoing survey might have conveyed the impression that heredity in the sphere of mind is effective in producing freaks and lunatics. I hasten to disabuse you of this idea. Ancestors do not always load the dice against descendants. The seeds of greatness too in all spheres of life are sown in the generations long gone and forgotten.

I cannot illustrate this point better than by drawing attention to the family of Jonathan Edwards, which is so often cited in the literature of Genetics and Eugenics. Winship, one of the descendants of the famous theologian, gives the following account: "1394 of his descendants were identified in 1900, of whom 295 were college graduates; 13 presidents of our greatest colleges, besides many principals of other important educational institutions; 60 physicians, many of whom were eminent; 100 and more clergymen, missionaries, or theological professors; 75 were officers in the army and navy; 60 were prominent authors and writers, by whom 135 books of merit were written and published and 18 important periodicals edited; 33 American States and several foreign countries and 92 American cities and many foreign cities have profited by the beneficent influence of their eminent activity; 100 and more were lawyers, of whom one was our most eminent professor of law; 30 were judges; 80 held public office, of whom one was vice-

president of the United States ; 3 were United States Senators ; several were governors, members of Congress, framers of state constitutions, mayors of cities, and ministers to foreign courts ; one was president of the Pacific Mail Steamship Company ; 15 railroads, many banks, insurance companies, and large industrial enterprises have been indebted to their management. Almost if not every department of social progress and of public weal has felt the impulse of this healthy, long lived family. It is not known that any one of them was ever convicted of crime." (1)

The interrelated families of Wedgwood, Darwin and Galton likewise show the influence of beneficent heredity. Kellicott gives a condensed history of the families extending over five generations. Out of a total number of 46 individuals given in the chart, there have been 16 distinguished scientists, 9 of whom have been Fellows of the Royal Society. Such a description gives us a general assurance that the complex patterns of traits that make for success in these varied types of orientation, possess a hereditary basis. More precise analysis is needed to bring out the form and the extent of inheritance. We shall proceed to consider this aspect of the problem.

§ 2. *Trait-Complexes*

Each *ability* that enables man to adapt himself to the environment, physical and social, is a complex of what we have defined as a '*trait*' in Chapter I. It is quite reasonable to suppose that single traits are inherited but do not always unite in such a manner as to constitute *abilities*. The latter represent the *patterns* which the traits form in meeting the situations which the individual has to face.

The formation of trait-patterns, however, depends not only upon the elements that are inherited but also upon a number of other factors. It depends upon the time and space aspects of the situation, as also upon the course of nurture and the stress to which the individual is sub-

jected. These represent a large number of variable factors. The estimate of inheritance on the basis of abilities that are elicited in the daily concourse of life can, then, be correct only within wide limits of error.

Still, it is found that these abilities run into families. The method of study is a statistical analysis of occurrence of the ability in question in selected family-groups, any member of which possesses the ability to a marked degree, and in an equal number of families among the general population. It is found that the former group possesses the ability in question in great excess of the latter group. The distribution, again, is such that it cannot be easily accounted for by such factors as common environment or imitation. It is reasonable to suppose, then, that heredity plays its part in the incidence of these abilities.

(i) Let us consider an ability, the capacity to mechanical invention. It is manifestly dependent on a large number of mental processes. There is no unitary mental function which may be called inventiveness. It resolves itself into an interplay of a large number of traits. Memory and imagination, the capacity of substitution of one part by an imaginary one and accuracy of space-estimation, are some of the functions. Some of these are 'traits' in the sense in which we have defined the term while others may more conveniently be thought of as products of experience. Inventiveness as an ability grows through a gradual interlacing of the traits representing the native psycho-physical equipment with what training and environment yield.

Such interlacing would largely be due to factors that cannot be adequately estimated. The ability appears for this reason as an accident and a 'gift'. Yet, if a comprehensive survey be made of several generations, the specified ability with respect to which the study is made, would be found among more members of a gifted person's family than among people of the same social and educational status selected out of the members of the general public. If the fact of larger incidence cannot be

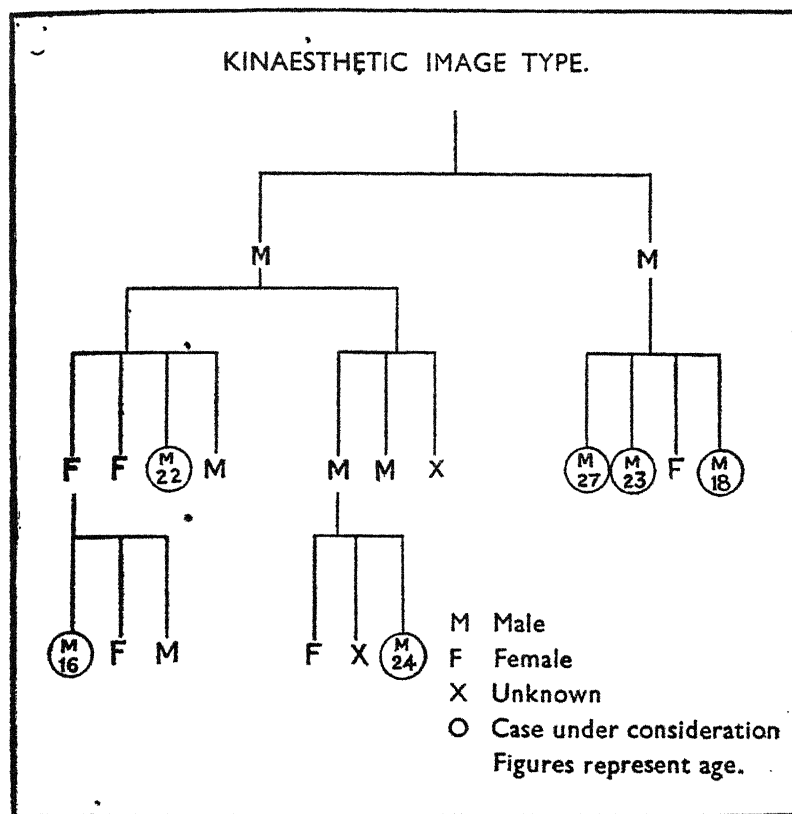
accounted for either by training or environment, the plausibility of explanation on the basis of heredity would increase. It may even be said that the increase will be in direct proportion to the difference between the frequency of the ability in the two cases mentioned above.

This is the principle which has been generally accepted in the lines of studies pursued of late for discovering the influence of heredity in the determination of abilities. A questionnaire was issued to 700 inventors of the United States. 40% of them had relatives who were inventors. 66.4% of the adult children of the inventors showed inventiveness. Most of the inventive children belonged to inventors who had inventor relatives (2).

(ii) The inheritance of mechanical ability, likewise, seems to be a family trait. A pedigree is given in which 11 out of 12 individuals show decidedly superior mechanical ability (3). Likewise, 17 out of 46 blood relations of a single family tree are said to exhibit interest towards science and also a certain degree of ability in scientific pursuits (4). These facts are mainly suggestive as all statistical surveys of this nature are.

I have observed the members of a group of a goldsmith family among whom a peculiar trait, that of reproducing a design over which the hand of the individual had been made to move passively, was markedly developed. The several designs were cut as grooves on pieces of wood, and the persons, blindfolded, moved their pencils over them. One to three repetitions were usually needed for most of them. From 7 to 12 practice trials were needed for a control group belonging to the same vocation and roughly of similar age group. The success, it seems, is largely based upon a well developed kinæsthetic imagery. Moreover, out of possible 17 members 6 were found to possess the trait. In the case of a control group of 14 not one possessed the capacity to this extent. A similar case is reported in which among 13 blood relations 5 could execute a design with marked ability. This, too, implicates a marked development of kinæsthetic imagery (5).

CHART No. 5.



Musical ability, likewise, partly depends upon the capacity to retain auditory images of tones. It is said of famous composers that they hear the scores of a symphony played before their mind prior to their composition. There are numerous instances in the heredity of musical talents which would imply the possession of a highly developed tonal imagery. It is said that the progeny of the German bard, Gassmann, exhibit musical ability up to the fifth generation. It is, likewise, stated that seven generations of the family of Bach and five generations of the family of Mozart have shown unusual musical skill in each generation (6).

Another instance of well developed musical ability is found among the six generations of descendants of one Georg Melchoid Linnenberger, a choir master. The following table represents the distribution of the ability (7):

TABLE I.

10 could sing and play more than one instrument.
6 could sing and play one instrument.
6 could play but could not sing.
27 could sing but could not play.
8 could do neither.

The occurrence of such variations in the range of musical abilities suggest the hypothesis that the musical ability is a complex of traits. The individuals do not usually inherit it as a whole but in its partial components. These may be supposed to come together by chance (8).

Koch and Mjöen, however, would like to make the following generalisations on the basis of these studies :

(i) If both parents and 4 G.P. are positively or negatively musical, the children resemble them.

(ii) If only one parent possesses the trait, $\frac{1}{2}$ of the children are positively musical.

(iii) The study of the collaterals gives a quantitative measure of the probability of occurrence of the musical talent (9).

§ 3. *The Abilities of Twins*

Twins possess a maximum amount of common heritage and if they are brought up together, also a maximum degree of common contribution of nurture and environment. We should expect, therefore, that there should be a high degree of resemblance between the abilities exhibited by twins in the various fields. There are, as we know, two kinds of twins, the *di-zygotic* and the *mono-zygotic* or the *identical twins*. The former are born from two separately fertilised eggs ; and the latter are born from one egg which is enclosed in one chorion. The

latter would naturally be expected to have a greater affinity of inheritance than the former. If, then, the abilities of the latter exhibit a higher degree of correlation than in the case of the former, we would be justified in laying greater stress on the contribution of heredity.

(i) An investigation was carried on in regard to the ability of a group of children to orient themselves to subjects of study in school. Such ability was measured in terms of the various orders of marks obtained in school. Among these there were 120 mono-zygotic twins (64 boys and 56 girls) and 82 di-zygotic twins (40 boys and 42 girls). All the pairs were of like sex. It was found that the intra-twin difference is greater in the case of di-zygotic twins than in the case of mono-zygotic. It was also found that such difference was maximal in early puberty (10).

The last proposition draws attention to another familiar fact. It is well known that the General Intelligence factor or the G-factor grows less in importance after the years of early puberty. The S-factors or special skills that the individual acquires, determine the success of performances. In the investigation in question, then, the period during which the G-factor is believed to predominate shows a maximal difference. The later years in which the S-factors predominate show less difference. But the S-factors, in this case special success in the different school subjects, are the consequences of special training in these directions. The G-factor represents the constitutional and hereditary factors to a much greater extent. It follows, then, (i) that twins exhibit greater resemblance in their abilities than unrelated pairs ; (ii) that the identical or mono-zygotic twins that may be presumed to possess the maximal degree of common inheritance exhibit also the maximal degree of resemblance in their abilities ; (iii) and the period during the G-factor, which is largely based on inheritance, plays its part is the period of maximal difference for the di-zygotic twins. Training and environment lead to the growth of the S-factors and level up the differences.

(ii) There is another study of the same type : 46 pairs of di-zygotic and 47 pairs of mono-zygotic twins of junior high school age were tested in 'pursuit rotor', speed-drill, packing and card-sorting. These abilities implicate, among others, a low reaction-time-value, greater visual acuity, increased capacities of space estimation and steady attention. Some of these are based on constitutional factors which in their turn are based on inheritance.

It was found that intra-pair resemblances were higher in the case of mono-zygotic twins than in the case of other twins. The resemblances of these abilities were of the same order as those of anthropometric measurements. These measurements, however, reveal features that are mainly hereditary. This fact suggests that the resemblances of the motor abilities specified above may have a hereditary basis (11).

(iii) A recent study has attempted to estimate twin resemblance with respect to association-time scores. The function depends upon so many variable factors that it is very difficult to obtain from the study any clear evidence of influence of the inheritance factor. The following table gives the data (12) :

TABLE II.

Twin-Resemblances in Association-Time Composite Scores :

	Identical Twins 26 pairs.	Fraternal Twins 26 pairs.
P—Scores (8 words)	.34	.31
I—Scores (8 words)	.36	.25
U—Scores (8 words)	.19	.21
Total Scores (24 words)	.38	.21

P=Pleasantly toned words; I=Indifferent; U=Unpleasant.

The author suggests that the correlation is higher for the mono-zygotic twins. But the low range of r -values makes it impossible to draw any conclusion in regard to

the parts played by heredity and environment. Not all abilities, then, would give a clear evidence of inheritance. The positive conclusion in regard to inheritance, if any, can be reached in this sphere only on the basis of studies covering a large range of abilities. Some of the abilities depend more on the constitutional and inheritance factors. Others represent the influence of nurture to a greater extent. The presumption of inheritance in the sphere of abilities and talents can then rest only on the weight of statistical evidence.

§ 4. *Difficulties in the Analysis of Talents and Abilities*

The facts surveyed above raise a strong presumption in favour of inheritance of abilities. Yet, they are not enough to prove beyond doubt the fact of inheritance. Certain difficulties are inherent in the problem itself. We conclude the present chapter with their consideration.

(i) In the first place, we have indicated above that abilities and talents represent interlacings of heritable traits, effects of nurture and the influence of the environment. It is not possible to point out in most of the cases the traits, the elementary functions which are supposed to be inherited. In the absence of such *identification* we are left only with a strong presumption and nothing more.

(ii) Each trait and each ability like the structures of the organism, are subject to spontaneous variation and mutation. It is difficult to ascertain, then, how far any given ability or the trait implicated in it, represents a variation of this nature. Mental functions, even within the span of daily life, undergo wide variations. Imaginations, impulses and motor abilities wax and wane. It is difficult to begin the estimate of inheritance with such a widely variable entity as a starting point. Since such abilities would exhibit large variations in the same individual and in different individuals in the same generation,

the chances of establishing correspondence between individuals and generations would be small.

This consideration leads us to two conclusions : (a) It would not be possible to establish strict numerical correspondence or ratio that we are accustomed to find in the case of bodily traits. (b) But when we find unusually high qualitative correspondences in the face of these difficulties, the presumption in favour of inheritance is strengthened.

(iii) It is said that hereditary effects should be "stated comparatively and mathematically in terms of development which occurs when different new born organisms are provided with identical surroundings and treatment" (13). The difficulties in the way of such numerical statements are obvious. Workers may apply different scales for the measurement of an ability. The computation of correspondences between these scales becomes then a matter of a new investigation. The real difficulty arises in the numerical estimation of the abilities in the different generations. For, there may not be a common basis for numerical valuation. The precision that is aimed at, then, cannot be realised.

(iv) Talents and abilities, as has been suggested above, are complexes of traits. It is, then, possible to find that a descendant possesses only one phase of the ability of his ancestor and *vice versa*. It has been suggested, for instance, that the musical talent because of its complexity is never inherited as a whole. It is found in several generations in its partial components (14). It is very difficult to observe the fact of hereditary transmission in such cases unless we conceive of a talent as a unitary whole the parts of which distribute themselves among ancestors and descendants. Such a conception always introduces a subjective factor. The objective reality of a talent under these conditions becomes a matter of speculation.

These difficulties arise very largely in the case of these variable functions that we have called 'abilities' and 'talents'. There are other mental functions which re-

main relatively constant. Some of these have been considered in previous chapters ; and some of them will be discussed later. The objections that have been pressed here do not affect the question of inheritance so far as these relatively less variable functions are concerned.

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CHAPTER VII

INHERITANCE OF INTELLIGENCE.

§ 1. *Introduction*

Intelligence as a psychological concept has a much wider connotation than the term intellect. The latter is regarded mainly as a mental function which enables a person to carry on abstract thinking, to educe relations, co-ordinate items of experience, make generalisations and draw inferences. Intelligence in addition to these comprises the capacities of quick adjustment to situations, of application of past experience and general principles to a present problem, of selective attention and response to a complex course of events. It is not necessary for our present purpose to aim at a precise definition. The description given above is sufficient in this context.

It is commonly accepted that we can form a fair estimate of a person's intelligence on the basis of his efforts at meeting the various situations in which he is placed. The intelligence tests attempt to prepare imaginary and conceptual situations that can be intellectually grasped or can be perceived and acted upon. The success and failure of persons to adjust themselves to these *prepared situations* enables us to form an estimate of intelligence analogous to that operative in daily life. But since these situations are *prepared* and *controlled*, they can be *graded* with respect to their difficulty. A failure in the tests, then, is not merely a performance of low quality. It is a performance in reference to a situation of a *certain order of difficulty* which can be quantitatively estimated. Hence, it is possible to estimate the *quantity of failure*. And it is possible from this, it is argued, to estimate the quantity of success.

Such success or failure may be relative to age, relative to experience and in some cases relative to the quality of the mind. . This last idea signifies that certain persons are so constituted that whatever their age and experience may be, they would be unable to adjust themselves to situations beyond a certain degree of complexity. But the order of difficulty and complexity of the problems and situations are relative to various age-levels. Hence, the quality of intelligence is finally equated with intelligence of certain age-levels.

Various scales of problem-situations have been devised with practically the same basic idea. It is believed that intelligence exhibits itself through many channels of response. A computation of the degree of success and failure of these different types of response would give a clue to the quantum of intelligence.

There are various methods of computation of the score or value of intelligence. The most widely used method is the one that represents the *quotient* of intelligence as a ratio between the *mental age* and the chronological age expressed in the shape of a percentage. The mental age is measured by the test-situations, corresponding to the age levels, in which the person succeeds or fails. The chronological age is expressed in years counted from birth. It is believed that this *quotient* does not alter to any appreciable extent during the period of normal growth for any given individual.

The I. Q. or Intelligence Quotient then may be supposed to represent a constitutional factor. Since the latter to a large extent depends upon inheritance, the I.Q. may be said to reflect hereditary factors. A comparison of the I.Q. of the members of the same family would, then, give us an idea of the extent of its heritability.

Yet one must not lose sight of the fact that the I.Q. is computed on the basis of the scores yielded by a number of special functions. These reflect the process of growth and maturation which implicate the influence of environment. Hence, it is not possible to isolate the

heritable phase of intelligence. Nor is it possible to say that the intelligence is a hereditary trait. At the same time, there is a considerable body of evidence to show that there is a hereditary factor at the base of intelligence.

§ 2. *Method and Data*

The method which has mainly been pursued in the study of the question of inheritance of intelligence is the comparison of the I.Q. of twins. Such comparison is instituted between mono-zygotic and di-zygotic twins, between those brought up together and those brought up separately. These comparisons are said to bring into relief the influence of heredity, if any.

The *mono-zygotic* twins possess a minimum difference so far as the heredity factor is concerned. „If then they exhibit a close resemblance in the type and degree of intelligence when they are separately brought up the resemblance should be attributed to heredity. If on the other hand, such twins brought up in the same environment manifest marked differences in their personality and intelligence, the factors of environment and nurture operating differentially may be regarded as the causal determinants. I shall present here certain recent studies on both of these lines.

Again, the *hetero-zygotic* or the fraternal twins can be studied with respect to their mutual likeness. There are instances when the members of a pair have been brought up together. There are other occasions when they have been separated early in life. It is thus possible to compare their intelligence under varying circumstances. As a matter of fact there are many studies on these lines and I shall present some of these here.

Hermann and Hogben published in 1933 a comparison of the Intelligence Quotient of mono-zygotic and di-zygotic twins as also of siblings. A second study was published in the same year by another pair of workers. These are presented in the following tables (1) :

TABLE I.

Subjects Examined.	Correlation bet. I.Q.
Mono-zygotic twins ..	.. .84 ± .04
Di-zygotic twin of like sex ..	.. .47 ± .08
Di-zygotic twin of unlike sex ..	.. .51 ± .06
Siblings .. ..	.. .32 ± .09

TABLE II.

Subjects examined.	Correlation bet. I.Q.
Identical twins ..	.. .84 ± .04
Di-zygotic twins ..	.. .35 ± .05

The resemblance of the siblings, however, is not well-authenticated. Davis has published a study of a very large number of children living in an orphanage. He holds that the siblings who have been together even up to nine years do not exhibit any more resemblance than those who have been together for one to three years in the same environment. He argues that unrelated children who are reared together would not exhibit a high degree of similarity simply by virtue of their being brought up in the same environment (2).

The question whether mental resemblance bears any relation to the degree of physical resemblance is made the subject of another study. The subjects of this study are elementary and High School students, 34 of the former and 84 of the latter. The latter group was divided into several sections on the basis of the degree of likeness, the sections representing from the largest to the smallest degree of physical similarity adjusted on the basis of a 9-point scale. It was found on the application of Intelligence tests that those who look alike are not mentally alike or *vice versa*. Of 4 siblings with very close physical resemblance two showed very close I.Q. value and two had larger variations. The problem so far as

siblings are concerned, then, stands on a very uncertain footing (3).

We shall now turn to reports on the study of twins. School marks of 120 mono-zygotic twins (64 boys and 56 girls) and 82 di-zygotic twins (40 boys and 42 girls) in Germany have been subjected to analysis. All the pairs were of like sex. It is found that intra-twin differences are greater in the case of fraternal twins and that the differences are maximal in early puberty (4).

A study of two pairs of twin girls seems to suggest the importance of the hereditary factor. The twin girls whom we shall call B and J were separated when they were two weeks old and never met until they were 18. When they were tested psychologically their mental equipment was found to be of the same standard and pattern. The following are the data of observation and tests :

- (i) Both were fond of reading ;
- (ii) Both had two attacks of tuberculosis at about the same time ;
- (iii) The Army Alpha Test gives B a score of 156 and J 153 out of a possible 212 ;
- (iv) Otis Advanced Intelligence Test gives them 64 (B) and 62 (J) out of a possible score of 75.

Two other twin girls, to be called B and D, were separated when they were only 14 months old until when they were 16. B and D were subjected to tests after they were married and had children. The data of the mental tests reveal that their level of intelligence as estimated by three scales of tests was practically the same as the following table shows :

TABLE III.

Tests.	B	D
Stanford-Binet	93	89
Otis self-administered	89	86
International	74	69

Such resemblance, it is suggested, can only be accounted for in terms of heredity ; for, the girls were brought up under different circumstances (5).

But we must not forget to look at the other side of the shield. Two identical twin girls of 24 years had been reared apart. There were differences in their bringing up. One had High School education for four years and the other for six weeks only. When intelligence tests were applied to them the one with higher education had higher scores. The difference in the mental age between the two was about 3 years. Differences were also found in four other cases of identical twins reared apart, but not to this extent (6).

Shuttleworth, on the basis of the data of studies of twins, attempts to estimate the specific contributions of nature and nurture to the Intelligence Quotient. He says that from 62.6% to 66% of the individual differences in the I.Q. is due to heredity. 2.2 to 3.3% is due to accidents and intra-family environmental difference. 13.9 to 17% of the difference is accounted for in terms of inter-family differences. 16 to 20% of the difference is due to heredity and inter-family environmental differences taken together. The author concludes : "It does not follow that the general level of environment is a relatively unimportant factor in determining the general level of intelligence ; but *only* that the environmental differences are relatively small in comparison with the hereditary differences in determining the differences in intelligence." (7).

§ 3. *Intelligence of Persons Brought up in Unusual Environment*

The view of heredity that Shuttleworth stresses is said to be inconsistent with several other orders of facts. If intelligence were an inherited trait, it would exhibit itself under varying sets of physical and social environment. This, however, does not happen in certain crucial instances.

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(i) The best recorded case is that of the Wild Boy of Aveyron studied by the French physician Itard at the close of the 18th century. Three Frenchmen found in 1799 a boy of 11-12 in a forest. He was entirely naked and unkempt and seemed to be leading an animal-like existence. His body was scarred and bore evidence of an arboreal mode of life. He could not speak and seemed to be scared of men. When closely examined, he was found to be deficient in all forms of behavioural development. The sensory and the motor, the intellectual and the emotional aspects of life appeared to be undeveloped. Itard tried to train the boy for five years, and failed to effect much improvement. He could not teach him, in spite of his best efforts, the elements of articulate speech, though he learnt simple written language in terms of which he expressed his wants. On the whole, the boy could not be brought up to a normal level of development under the best of circumstances (8).

It is argued from this fact that the early environment has a determining influence upon intelligence. The early life imposes its stamp upon intellect—a stamp which is never effaced. It is more reasonable, however, to suppose that this particular boy was mute from central defects and probably also an imbecile. These two suppositions, which unfortunately cannot be adequately checked up with the facts that are available, would explain the condition as well as the limited character of growth. The instance, thus, cannot be regarded as crucial for the present purposes. Had the boy developed into a normal being under the changed environment, the greater influence of the environment could have been proved. As it is, it is a case of 'not proven'.

(ii) The case of Kasper Hauser, reported in the literature of Mental Deficiency, is also pressed to the service of proving the great influence of environment upon maturation of intellect.

A boy of about 17 was found wandering about the streets of the Nuremberg. To every question he gave the same answer: "My father was a trooper so would I

be." He seemed to have some mystery about his birth. It is surmised that he was the heir to a princely house and was confined in a dark cell by his enemies. Professor Danmer gave him training by which he seemed to have made rapid progress. Though still not quite up to the normal standard, he could get along in daily life. He was finally placed under the charge of Lord Stanhope and employed at the court of appeal. He is said to have carried on his work though without distinction. After a few years, he was lured away to a place by an unknown person by giving him hope that the mystery of his birth would be revealed. He was, however, stabbed to death.

Upon a post-mortem examination it was found that the brain was of a much smaller size and the convolutions were not well developed. Tredgold argues that it is an instance of what is called "*Isolation Amentia*", an arrest of intelligence due to isolation (9). This is interpreted by Tredgold to signify that confinement in the dark cell caused the arrest of growth both mental and cerebral. It is possible to understand how there might be an arrest of intellectual growth through absence of social contact. Absence of speech function and of other responses that a group life demands, might conceivably retard the growth of intelligence. And the restoration of human contact would lead to a rapid growth of these functions. Indeed the case of Kasper Hauser really contradicts the conclusions drawn from the case of the Wild Boy. It is concluded from the latter that the speech function could not develop at all due to early isolation. The former case proves that the capacity of speech may develop rapidly when social contact has been restored.

But Tredgold seems to think that the small size of the brain and the simpler schema of convolutions exemplify "in a unique manner the effect of prolonged isolation upon the cells of the brain". There is no evidence, however, that apart from the insufficiently developed functions of his limbs of locomotion and prehension, there was any other sign of arrest of development of the body. It is, therefore, difficult to see how the brain, of all the

organs, could suffer retardation under the conditions of isolation and darkness. Again, the skull, when examined in anatomy was found to be thick. Even if the cortical cells could remain undeveloped in the absence of social life, the thickness of the skull could not be traced to the same cause.

It would be more reasonable to suppose that Hauser was a high-grade imbecile or a moron. His relatives, whoever they were, wanted to keep the family skeleton literally in the cupboard, in a dark-one. Such an hypothesis would enable us to avoid the more speculative theory of the alteration of the size of the brain and of the number of convolutions through the operation of the factors of the environment.

(iii) The cases of Kamala and Amala, the wolf-children of Midnapore in Bengal, are said to support the theory of determination of the personality by the environment. These children are supposed to have found their way in the jungle and lived with animals until rescued by certain persons and brought up by certain Christian missionaries. There is undoubtedly a great deal of fiction superimposed upon a small superstructure of truth in this story.

It is stated that these girls were discovered in a 'sparsely populated' part of the country. Midnapore can hardly be called that. Again, these children appear to have acquired the habit of carnivorous animals like wolves. It is not everyday that tales of ravages of tigers and wolves are heard in that part of the country.

The more reasonable supposition seems to be as follows : The district in question is inhabited by a large population afflicted by chronic poverty. It supplies a very large number of casual labourers. It also supplies a large number of beggars. Orphaned children under such conditions would have no one to look after them. They would in their earlier years be cared for by any one taking pity on them. When they grow up, they would wander about the village eating and sleeping wherever

they could. Mute, paralysed and ament children, without parents or relatives to look after them, would grow up outside poor men's huts and in the shades of the jungle. They would, due to a paralytic condition, walk on all fours and would only be capable of howling on account of mutism. This is more likely to be the case that has been embellished beyond recognition by propaganda. This case, no more than those recited above, can prove the theory either of heredity or of environmental determination of intelligence.

§ 4. *Intelligence of Persons under Unusual Social and Economic Environment*

Another group of studies is intended to show that the economic and social environment, rather than inheritance, truly determine intelligence.

(i) *The Canal-boat Children :*

These are the children of those living in the canal boats. Most of the adults are illiterate and the family lives in a condition of relative social isolation, so far as organised social life is concerned. There is no dearth of human contact and variety in the life of the family and of the children, though there is an absence of the sense of regional adjustment.

These children attend school only to the extent of about 5% of the days that ordinary children are expected to attend. Most of them are thus able to attend school about two days, which are often half-days, in the course of a month. Gordon applied a battery of Stanford-Binet tests to these children in the course of his work as Inspector of Schools. When a group of 76 canal-boat children were tested, their average I.Q. was 69.6. Such a low value marks the border line between the dull and the sub-normal. In the case of the younger children, however, the I.Q. ranged between 90-100. These are, then, normal in regard to their intellectual growth. The low value of the entire group, thus, must be due to a low

I.Q. value of the older children, or, in other words, due to a negative acceleration in the growth of intelligence.

Gordon attempts to explain the fact in the following way : The absence of schooling does not materially affect the smaller children. The simple family environment is sufficient for their mental growth. Differential social and scholastic environment are necessary to stimulate the mental growth of the older children. These, however, are absent in these instances. The growth of intelligence of the older children is arrested for this reason.

Another highly significant fact is brought to light by Gordon's analysis. It is found that the mental ages of children of the same family are numerically very similar to one another. This is true even when the chronological ages are different. Gordon seems to think that the mental ages of children of a family tend to have a common limiting value. In other words, each family group possesses its own limit of intellectual development. The known common factor in these cases is the simple environment of the family group. Hence it is concluded that the nature of the social group, namely, the family determines the level of intelligence.

(ii) *The Gypsy Children :*

A similar study was made by Gordon of the gypsy children. The gypsy children miss about two thirds of the total number of days that schools are open. The average I.Q. of a group of 82 children is given at 74.5. It was also found that children whose percentage of school attendance was lower had a lower I.Q. As a matter of fact the coefficient of correlation between the two was found to be .36. In this group, too, there was a decrease of the I.Q. with the increase of age. But the negative acceleration did not occur in the families which could show a good record of school attendance. Gordon, therefore, draws the obvious conclusion that intelligence is determined by the social-economic environment and schooling rather than by a dominant inheritance factor.

The relative unimportance of the inheritance-factor in these cases is suggested on the basis of the following arguments : (a) The groups in question are not select groups in the sense that duller persons gradually find their way towards these occupations and social orders. The gypsies seldom admit strangers. The canal-boat people cannot afford to be shiftless or lacking in mental alertness. They have to begin early. The vagabond cannot simply walk into this mode of life which has to be mastered by apprenticeship. (b) The younger children show a normal level of intelligence. It is, thus, not possible to say that they are born dull. (c) Those who attend school more often, do so because of compulsion. It would be true to say that intelligent families more readily send their children to school. The better schooled, and therefore the more literate children, are for this reason descended from a more intelligent stock. Intelligence, in both of these cases, according to Gordon, then, should be explained in terms of the character of the family group and influence of the school (10).

The conclusion formulated above needs further consideration. If schooling be a determining factor, the increase in the amount of schooling should show a corresponding increase with the value of the I.Q. We find, however, that the canal-boat children with a 5% of attendance of the total number of days show an average I.Q. of 69.6. The gypsy children with a schooling of 34.9% show an I.Q. of 74.5. On the other hand, the difference in the intelligence level of the younger and the older children of the canal-boat group is of as much as 20-30 units. Another factor, then, other than schooling and the home environment, is at work.

It is well-known that certain racial groups exhibit the phenomenon of the early arrest of intellectual development. There is even an early decay or a marked negative acceleration. Such phenomena have been found in the hybrid generation produced by the mixture of culturally high and culturally more primitive races. The late Sir B. N. Seal had especially drawn my attention to

several thousands of school and High School examination marks of pupils coming from a particular section of people in North Bengal. It was found that these boys had excellent records in the early years between 7-10, or even up to 12. The same boys rapidly deteriorated with the onset of puberty and after it. The result is clearly observed even to-day. Boys who appear to be normal and even bright in the lower forms, fail so often later that they cannot complete their school-career. Sir B. N. Seal told me that his long experience among the people of this region led him to suspect a constitutional factor to be at work.

I suggest that the situation among the gypsies and the canal-boat children is analogous to this. A constitutional factor is most likely at work among these people as it is operative in the cases cited above. In the case of gypsies a racial-constitutional factor is manifestly involved. It is less apparent among the canal-boat people. But that type of life is likely to appeal only to persons with certain types of mental and bodily make up. It is not unreasonable to suppose that a population with particular characteristics would grow up through selective breeding. The term 'family milieu' does not possess enough meaning to account for the facts we are considering. It signifies the narrow limits of the boat, the parents, the talk, the food and the round of activities. We might just as well explain intelligence in terms of the free air of the river or the flowing water.

The analysis of the cases considered above shows that it is difficult to make up one's mind in regard to the interpretation of the phenomena. The facts cannot be explained entirely or principally in terms of the environment. The factor of inheritance has certainly a part to play. The incidence of a lower degree of intelligence in particular family groups and the high coefficient of correlation between the I.Q. of the twins, suggest the operation of heredity. Yet, the analysis of facts does not lead us unerringly to an inheritance factor. So far, then, as the data and the methods surveyed in the present section

are concerned, we must again conclude with a verdict of 'not proven'.

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CHAPTER VIII.

FAMILY AND INTELLIGENCE.

§ 1. *Correlation of Intelligence with the Various Phases of the Family-milieu*

It was observed in the preceding chapter that a theory of determination of intelligence by family-life conceived as an environment, does not lead to any fruitful solution of the problem of inheritance. It is necessary to analyse the family environment into certain phases that are significant for the present problem. Such analyses have been carried through in recent years, and it will be our purpose to approach the problem of inheritance from the point of view these data.

(i) *The order of Birth and the Age of the Mother :*

It is suggested by Shrubsall that defective children are more likely to come later rather than earlier in the order of birth. This fact is also supported by the analysis of the maternal age in relation to the proportion of dull children. The following table computed by Penrose on the basis of his study of ninety-four families illustrates the point :

TABLE I.

Maternal Age.	25 yrs.	25-29 yrs.	30-34 yrs.	35 and above
% of the Dull and the Ament	27	30	36	40

(ii) Penrose further analysed the general condition of homes of families that breed sub-cultural children. The condition at home, the number of rooms in which

a family lives and the standard of comfort, are expected to bear some relation to the intelligence of the father and the mother. The former would exhibit it by his capacity of earning and the latter by her economy and organisation. The correlation between the mental level of the father and the estimated plane of home life is .25 ; that between the mental level of the mother and home conditions is .32. The correlation between the intelligence of sons and home conditions is .17. The intelligence of daughters, however, bears a correlation of .22 with the home condition (1). Such slight correlation values do not justify the conclusions that Gordon draws in regard to the influence of the level of family life on the I.Q. of the children of the canal-boat population or of the gypsy community (Ch. VII).

§ 2. *Mental Status of Parents in Relation to that of Children*

We have seen in the previous section that attempts at correlating the mental status of children with the amount of schooling and conditions at home have proved unsatisfactory. Other investigations have, however, been carried on in regard to the filiation of children's intelligence with certain aspects of the family situation. One such aspect is the intellectual status of parents. In the case of the level of family life, the final correspondence which is brought to light is really with the intellectual plane of parents. It is presumed that intelligence of parents reflects itself in the financial status and good organisation of the home. There may, however, be other factors operative in these cases. Hence, the correlation that is obtained appears to have a low value.

An attempt at the discovery of a direct correspondence between the intelligences of parents and children, however, appears to prove more successful. The following table gives a synoptic view of a survey of ninety-four families reported by Penrose :

TABLE II.

Quality of Parents and Number of Children of Different Qualities:

Quality of Children:	NF. NP.	NF. DP.	NP. DF.	NF. MP.	MP. DF.	MF. DP.	DF. DP.	MF. MP.
Superior	7	0	0	0	0	0	0	0
Normal	110	17	19	11	0	0	8	1
Dull	13	13	7	14	1	0	12	3
Mentally deficient	49	13	11	20	18	4	17	18
Total	179	43	37	45	19	4	37	22

N=Normal ; D=Dull; M=Mentally deficient; F=Father
P=Mother.

It will be noticed that many of the parents in the above table are sub-normal in their intelligence. The union of such persons is apparently *not* based upon their likeness of intelligence. Yet, there is a significant correlation in the studies in question between the two partners in marriage. It is found to be .44. "There is no example," says Penrose, "of a mentally defective father mating with a normal mother. Either for psychological or economic reasons such unions are rare. The complementary type of union, where a defective woman has a husband of normal intelligence, is comparatively common. One often finds, however, that the father in such families is of a neurotic character or otherwise mentally deranged : but whether this is the cause or the effect of the union is uncertain." (2)

The preceding analysis, then, points to four conclusions :

- (a) The home environment is not so significant as it is supposed to be by some ;
- (b) Parents with sub-normal and neurotic taint mate together ;
- (c) A high degree of the taint is associated with a greater frequency of the taint in the children ;

- (d) The frequency of children with superior and normal intelligence presupposes *at least* normal intelligence on the part of the parents.

These propositions undoubtedly point to the presence of an inheritance factor.

Yet, the proof for the presence of the factor falls short. The parent-child correlation with respect to intelligence, in the studies considered here, is .36. Fisher and Pearson, however, think that the correlation to be expected in the case of hereditary transmission should be .50. The value obtained in Penrose's study cannot be said to approximate this value. The author further states that with a correlation of .44 between parents, the expected value of child-parent correlation should be .65. It is suggested that the amount of dissimilarity measures the amount of influence exerted by the environment to counteract inheritance (3).

The trait inherited, however, appears to be *sex-linked*. The following table will illustrate the point :

TABLE III.

Relationship.	r	No. of Pairs.
Father—Son ..	.25	188
Mother—Daughter ..	.42	207
Mother—Son ..	.38	188
Father—Daughter ..	.40	207

It is concluded from this analysis that the parent-child likeness in intelligence "can be accounted for by the assumption of alternative additive Mendelian genetic factors, a noticeable proportion of which are sex-linked." (4)

§ 3. *The Study of Foster-children*

We may approach the problem of relation of parents' intelligence with that of children in another way. There is, in many of the countries, a fair number of children

living in homes other than those of their actual parents. In many cases, the transfer from one family to another has occurred very early ; in other cases, it takes place slightly later. In all these instances the child is brought up under an altered family environment and under the care of new personalities, better or worse.

The aim of several studies has been to discover the correlation between the level of intelligence of a group of children with the intelligence of their foster-parents ; the intelligence of a control group is computed with the actual parents of the children at the same time. If the study exhibits a markedly higher co-efficient for the former, it may be concluded that environment has a larger share in the determination of the intelligence of the child. If, however, the latter correlation has a definitely higher value, the factor of inheritance is to be given greater weight.

A number of studies of this description has been carried out with considerable precision in recent years. Burks studied a group of American children of English and Nordic stock in California. The age at the time of adoption was under twelve months and at the time of testing between five and fourteen years. Each foster-child lived in a family in which both the parents were alive. The control group of children was selected on the same principles, and the correspondence between the two groups in regard to other factors was secured as far as possible. The following tables give the main points of the study referred to here :

TABLE IV.
The Number Studied:

		Foster.	Control.
Children	..	214	205
Parents	..	382	105

TABLE V.

*Correlation (r) of Mental Age of Children with
the following :*

Parents.	Foster.	Control.
Father	.07	.46
Mother	.19	.45

Burks' studies estimated the mental age in terms of the Stanford-Binet tests. The conclusions drawn from these studies by the author are as follow :

- (i) The contribution of heredity with respect to intelligence is from 70 to 80%.
- (ii) Good home environment contributes from 10 to 30 points. Unfavourable home environment, likewise, accounts for the deterioration of about 20 points of the I.Q.

Similar investigations were carried on by Leahy and yielded similar conclusions in regard to the greater importance of inheritance. But there are certain disturbing factors to which the authors themselves draw attention :

(i) All the cases were taken from a group homogeneous in regard to economic, cultural and educational standards. If the samples had been taken from more markedly different environments, there might have been greater deviations in the control group or a greater agreement in the foster-group.

(ii) The correlation with the intelligence of the foster-parents may be disturbed by the attitude that the parents assume towards the child, or the child assumes towards the parents. The general tendency that we find in the natural parent-child relation, the tendency of the parents to expect the child to imitate the parents, may be absent in these cases. The parents may fail to function as determinants of the personality. This is not a mere speculative possibility. It is found that the intelli-

gence-level of children of the foster-group exhibits a higher correlation with the cultural standard of the foster-home than with the foster-parents. In Burks' study it is .25 in comparison to the parental correlation-values of .07 and .19; in Leahy's the values are .26, .24 and .19. It is possible to suppose that the parents failed to function as factors in the home-milieu on account of certain disturbing factors like the one suggested above (5). Thus, the material and the cultural planes bear a higher correlation with the intelligence of foster children than the intelligence-planes of foster parents.

§ 4. *The Study of Foster-children : Stress on the influence of the home*

The points brought out in the course of the critical analysis at the close of the last section, receive support from other investigations. A group of 401 children has been closely studied from several angles by Freeman and two other associates. The procedure was to divide up the children into the following *four* groups for the purpose of study :

Group I :

A group of 74 children were tested before adoption into foster-homes. The average age at adoption was 8 years. These children were also tested after they had been adequately adjusted to the foster-home. The tests suggest the following conclusions :

- (a) Those who were adopted into better homes showed a small but definite increase in I.Q. from the first to the second test.
- (b) Those who were received into poorer houses did not exhibit this increase.
- (c) The younger children showed this increase more definitely.

Group II :

Group II comprised 125 pairs of siblings each placed in different foster-homes. The average age for such

placement for the group being 5 years 4 months. The I.Q. of these siblings had a correlation of .25, 63 of the siblings who were adopted into homes of different cultural standing correlating by .19. Those that were adopted into similar homes correlated by .30.

Group III :

Group III comprised pairs of unrelated children living in the same foster-homes. Forty of these pairs consisted of a foster-child and a real child of the foster-parents. The correlation between the I.Q. of the two classes of this-group was .34. There were also 72 pairs of unrelated children brought up in the same foster-home. The correlation of the I.Q.s was .37.

Group IV :

Group IV comprised all the 401 children. The following r-values were worked out :

TABLE VI.

*The r-values of I.Q. of foster-children with
the home conditions :*

r	r-values.	No. of cases.
r-value of I.Q. with that of the foster-father .. ..	.37	180
r-value of I.Q. with that of the foster-mother .. ..	.28	225
r-value of I.Q. with the status of the home ..	.48	401

It is manifest that the environment exerts a determining influence upon the I.Q. in these cases, and its significance cannot anywhere be denied. Anastasi cautiously remarks : "Beyond this, however, it is impossible to generalise because of special difficulties inherent in each study." (6)

§ 5. *The Practical Importance of Correlation between the Intelligence of real Mothers and their Children in Foster-homes*

The studies so far considered are researches of theoretic importance. The question of correlation of the I.Q. of the mother and the child, however, has a direct practical significance. "Intelligence quotients of the parents," says an author in a paper recently published, "should be considered in placing a child for adoption, and to explore the possibility of using parents' scores as weights to increase the predictive value of intelligence tests of infants" (7). In both war and peace such placement becomes a fairly common phenomenon. The refusal on the part of women of certain social classes to bear the burden of motherhood, makes it necessary to adopt children when the mother-impulse demands fulfillment. A certain selection not only in the matter of health and appearance but also in regard to what the future has to promise, becomes necessary.

Such adoptions are usually made from the inmates of infants' homes or similar organisations. The recruitment to these institutions is made mainly from the classes for which the struggle for existence is very hard. Death of parents, need of the mother to work for her living, incapacity of the father to look after the child, divorce and desertion, are some of the causes that lead the state and the community to set up institutions of this type. War breaks up the family life temporarily or permanently and imposes special responsibility upon these organisations. The inmates of these homes, then, may be recruited from families with different levels of ability and intelligence.

Persons who adopt children, however, are beginning of late to feel the need of being assured of the intellectual prospects of the adopted child. It is necessary, then, to have a rating of the mental ability of the child. But the data of tests at a tender age may not

carry sufficient assurance. It becomes necessary, therefore, to discover if the reliability of the test-scores could be increased by working out the correlations between the I.Q. of the child and of its mother when the latter can be found.

The studies summarised above attempt to discover this correlation by an indirect method. We have seen that three types of correlations were worked out : (i) between the child and the foster parents ; (ii) between the child and the foster home conditions ; (iii) between a group similar to the group of foster children and their parents. It was intended to show that the difference in the two coefficients would exhibit the relative importance of inheritance. But the high value of the parent-child correlation in (iii) and the low values in (i) as found in the studies referred to above, may be explained as arising from the presence and absence of the parent child *rapprochement* that determines the direction of intellectual and mental growth.

The analysis that we are considering in the present section aims at bringing into relief the amount of correlation between the I.Q. of the adopted child and the actual parent from whom it has been separated in early infancy. If the correlation were high, the significance of the inheritance factor would be increased. A low correlation does not permit us to draw any inference in regard to the operation of the factor of inheritance. But it does not shut out the possibility of operation of the hereditary factor. For, a negative proposition is hard to prove.

The subjects in this case are Canadian children placed in the homes of fathers belonging to the middle class, in the economic sense, pursuing such vocations as those of salesmen, mechanics, factory foremen and book-keepers. All the families were British. The children were placed in homes between the first and the second years.

The following table gives the coefficients of correlation between the I.Q. of the real mothers and that of their children placed in foster homes (8) :

TABLE VII
Correlations Between the I.Q.s of Mothers & Children :

Age of Child.			r	N
Under 1 year	..	..	+ .115	31
1 to 1½ years	..	..	+ .082	118
1½ to 2 years	..	..	+ .079	109
2 years	..	..	— .119	128
3 years	..	..	+ .153	96
4 years	..	..	+ .045	52
3 years or more	..	..	+ .086	149
4 years or more	..	..	+ .129	93
5 years or more	..	..	+ .120	70
5 years or more*	..	..	+ .116	53

* Placed in foster-homes before the age of two.

The author of this study concludes that "the correlation is too low to warrant the use of mother's I.Q. in predicting the future rating of her child reared in another home."

The analysis of the data given by the author, however, brings to light several other interesting aspects of the question. (i) In the first place, the I.Q. of a large number of mothers in question was $78.30 \pm .61$. But there were also girls with a good standard of education whose I.Q. was not taken or considered in this. The I.Q. of one group of mothers was compared to that of all the children. This may account for the low correlation. (ii) It was found that 77 mothers with I.Q. of 70-79 had a lower percentage of subnormal children and had 17 children with I.Q. over 109. This is almost as many as produced by 235 other mothers. A child of a mother, according to this, with an I.Q. of over 69 has $\frac{77}{100}$ chance of being normal ; that of a mother with I.Q. over 89 has a chance of $\frac{79}{100}$ (9).

These results seem to be paradoxical, especially in the light of what we know about the pedigree of amentia. The explanation probably lies in the fact that the I.Q. of the other parent is not known in these instances. And since the inheritance is of the *alternative* type, we may

have in these instances the transmission of the factors that constitute intelligence of the male parent. We have seen in a previous section that union of intelligent males with subnormal females is not unusual.

These studies which are meant to be crucial, do not give a clear lead in regard to the problem of heredity *vs.* environment. The various sets of data do not bear one another out. And there are too many unknown factors in the analysis to make any conclusion decisive.

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- (3) *ibid.*—p. 10.
- (4) *ibid.*
- (5) Anastasi—*Differential Psychology*—p. 129-32.
- (6) *ibid.*—p. 133-37.
- (7) Snygg—The Relation Between the Intelligence of Mothers and of their Children living in foster-homes—*Jl. Genetic Psych.* 1938, June ; p. 401.
- (8) *ibid.*—p. 405.
- (9) *ibid.*—p. 404-5.

CHAPTER IX

CLASS, VOCATION AND INTELLIGENCE.

§ 1. *Introduction*

We have failed in the preceding chapter to discover any clear evidence of inheritance in the relation of the individual to his family. The facts that have been brought to light by the patient investigators lend support to different conclusions in different contexts. We shall consider in this chapter the problem of inheritance of mental traits on a wider background, that of classes and vocations.

The question may naturally be raised in regard to the value of this discussion. If a consideration of the intimate relation between a person and his family does not lead to any clear conclusion in regard to the problem of heredity, it would be too much to expect and new light from class and vocational filiations. The criticism is just in the abstract. The relation between a person and his family, as we have seen, has been explored in two different ways. We have studied it in the shape of pedigree; and we have attempted to survey it by means of statistical analysis of groups, to wit, a parental group and a children's group, with reference to a particular characteristic. The former type of analysis, namely, that of pedigree, has given us valuable data in regard to inheritance. It is the latter type of data that has not yielded unequivocal conclusions. It may, thus, be of value to follow the method of statistical analysis under a different set of conditions. This is the task that is proposed for this chapter.

§ 2. *The Intelligence of Children of Different Vocational Groups : General*

It is widely believed that the different vocational groups within a fairly homogeneous race or nation, represent different grades of intelligence and ability. It is certainly true that they represent different profiles of ability. If the analysis reveals that intelligence varies correspondingly with the economic and social status of the vocation, the fact can be interpreted in terms both of heredity and environment.

It may be suggested that the nature of the home and its associated amenities influence the level of intelligence. It may also be held that vocational success and status are determined by intelligence. And the fact of a gradation in the levels of intelligence in the children of different vocational groups, is an indication of inheritance.

Haggarty and Nash have published a study of 8122 children of the New York State. 6688 of these were in the elementary schools and the rest in High Schools. The following table sums up the data (1):

TABLE I.

Parents' Occupation	Median I.Q. Grade 3-8	Median I.Q. High School	% I.Q. of 140 or more Grade 3-8	% I.Q. of 60-69, Grade 3-8
Professional	116	121	11.75	
Business and clerical vocation	107	112	6.04	2.01
Skilled labour	98	111	1.94	3.59
Semi-skilled labour	95	108	1.15	4.19
Farmers	91	108	87	6
Unskilled labour	89	106	.40	10.34
				00.0

It will be observed that the Median I.Q. diminishes gradually as we proceed from the professional classes to the stratum of unskilled labour. Equally striking are the phenomena that the percentage of superior children

diminishes and that of inferior children increases as the survey proceeds from the professional classes to the classes that supply unskilled and casual labour. The reason probably is not far to seek. Given equal opportunities, persons who push up to the professions that ensure better social status and economic return, would have to succeed in a keen competition. They must then be supposed to possess some kind of ability that favours their success. And when these persons marry they usually select their mates from their own classes. It is not surprising, then, that children born of such parents would inherit certain traits that make for success, especially general intelligence.

The gradation of abilities, then, does not signify that vocations contribute in some way to a higher level of intelligence in children. It only means that persons with a certain intelligence-level choose a specific type of vocation and also mate among people who represent a certain high standard of ability and intelligence.

§ 3. *Gradations of Vocation and Intelligence : Analysis of Data*

This conclusion is borne out by the study of 380 pre-school children carried out by Goodenough. She applied the tests twice—the second one six weeks after the first. The age of the children varied from 18 to 54 months. The following table gives the data (2):

TABLE II.

Parents' Occupation.	I.Q. 1st Test	I.Q. 2nd Test.
Professional ..	116.1	125.0
Semi-professional ..	111.7	119.0
Clerical and skilled trades	107.7	113.4
Semi-skilled ..	105.3	108.0
Slightly skilled ..	104.3	107.4
Unskilled ..	96.0	95.0

Both of these sets of data confirm the view that children's intelligence-quotient diminishes as we descend from the upper to the lower ranges of the parents' vocational scale. The hypothesis of selective breeding, when the selection is based on intelligence, seems to be confirmed by this study as also by the preceding one.

The suggestion that the environment of the home is an important factor in the determination of the plane of children's intelligence appears to be less reasonable on the basis of Goodenough's study. The smaller children, those from 18 to 54 months, have less time to be impressed by the stamp of environment than the relatively higher age group. Yet, the maximum and the minimum I.Q.-values in both the studies (Tables I and II) largely correspond. The other values exhibit a similarity of gradation though there is no actual correspondence. This latter may be accounted for by the fact that different age groups, consisting of different individuals, were studied in the two cases.

A parallel line of study explores the relation between the educational status of parents and the I.Q. of children. Witty and Lehman have given the number of 'gifted' and 'inferior' children corresponding to the various levels of academic achievements of the two parents. Gifted children possess I.Q. of 140 and over. Inferior children possess I.Q. of 70 and less. The following is a tabular presentation of the data (3):

TABLE III.

Educational Status	No. of Gifted Children.		No. of Inferior Children.	
	Father.	Mother.	Father.	Mother.
High School ..	43	41	4	1
College ..	25	25	0	0
Business School ..	4	3	0	0
Elementary School ..	7	9	46	49
Av. years of school ..	13	12	4.5	4

Higher education at college and vocational training presupposes a higher degree of general intelligence. This may also implicate a greater degree of care given to the upbringing of children. But the latter hypothesis would not explain the remarkable absence of "inferior" children. For, subnormality of intelligence, as revealed by tests, is not a trait that can be abolished by training.

A similar type of data is reported by Duff. Among other lines of work, he has attempted to find the relation of the level of intelligence with the vocational status of the family. The procedure was to select two groups of school students, one with I.Q. of 136 and up, and another with I.Q. of 100 ± 5 . The former is called the "*Intelligent*" group and the latter the *average* or the "*Control*" group. So far as possible, a member of the former was paired with a member of the latter from the same school. The following table gives the number of children belonging to the two groups in relation to the vocational status of fathers (4):

TABLE IV.

Occupation of Fathers.	Intelligent Group. I.Q. 136	Control or Av. Group. I.Q. 100 ± 5
Higher industrial posts	6	0
Profession: Mainly teaching	13	0
Lower industrial posts, e.g. Commercial Traveller &c.	27	12
Clerical	9	8
Skilled labour	9	8
Semi-skilled labour	30	50
Unskilled labour	6	23

§ 4. General Resumé and Conclusion

The data show that the number of 'average' children increases relatively with the diminished status of vocations. It has been suggested in connection with Table III that the phenomenon in question may be accounted

for by the greater opportunities available to children of the higher vocational classes. Duff's analysis, however, negates this idea.

"It can be seen," so runs the argument, "that the fathers of the *intelligent* groups are not as a whole very distinguished persons. Only those in the first two groups can possibly give their children any great advantages in the way of material environment over their neighbours ; and even of these, about half are school-masters, and not, therefore, men of great wealth. Material environment cannot account for the children's high intelligence. At the same time there is a marked difference between the two groups. It is perhaps more easily seen by comparing the percentage in each group that reaches the level of skilled labour or higher (64% in the 'intelligent' group and 28% in the 'control' group)."

The facts so far recited suggest thus a heritable rather than an environmental factor. It is true that persons with a high I.Q.-value do not often succeed in vocations. It may be argued from this that children of parents successful in vocations need not be supposed to possess a high I.Q.-value as a heritable trait. But it must be recognised that a high I.Q. is not the *only* factor that makes for vocational success. There is a number of other factors. Let us describe these generally as *character* (*C*) which comprises a number of special abilities. We can then say that those who succeed in vocations or in academic life possess a high *I.Q. + C.*, the value of the two symbols varying for different types of economic and social pursuits. It will be seen that a process of selective breeding may lead to the inheritance of intelligence if the latter be conceived as a heritable trait.

The conception of a gradation of intelligence parallel to the gradation of vocations, therefore, has a plausible basis in facts. The evidence, however, is mainly of a statistical nature and may not be applied to individual sets of facts. The verification of the hypothesis, therefore, is wanting in the assurance that arises from the perception of concrete instances. We are led to believe

from such evidence that a class-wise gradation of I.Q.-values is a sound intellectual possibility. But practical conviction is often wanting (5).

The objection to the acceptance of the kind of gradation suggested above arises largely from political and social bias. Man's vanity prompts him to believe that he could shape himself into a much higher type of personality if society and environment were favourable. The same feeling compels him to deny distinctions that place him lower in a social economic or intellectual scale. His heritage, on which he has no control, cannot condemn him to perpetual inferiority. The lower intelligence, he comes to believe, is an accident ; it can be remedied by human effort.

Such sentiments stand in the way of a true appraisal of the facts, a recital of which has been given above. It is undoubtedly true that man's achievements can be much greater under better conditions of life. It is also true that environment, social and economic, plays strange tricks with one's career. But whenever we make a close observation of a personality, we are impressed by its strange limitations no less than by its gifts. These limitations, and often blindnesses, define the boundary within which the life shall move. The whole of this territory may not be explored. It is, however, a fact that man cannot go beyond it. Education and social opportunities may invest a person with a high status but not with great intelligence.

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- (3) *ibid*—p. 205.
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- (5) Maguinness—*Environment and Heredity* (Nelson)—Ch. VIII.

CHAPTER X

RACE AND INTELLIGENCE.

§ 1. *The Concept of Racial Intelligence*

The races of mankind are believed by most people to possess different degrees of intelligence. The estimate is usually based on three orders of facts: (i) The political and economic status of a race is often employed as a criterion of its intelligence which consequently is conceived as the ability for social and economic adjustment, (ii) Secondly, certain qualities such as initiative, inventiveness and the capacity to manipulate one's own resources, are regarded as the criteria of intelligence. Races that exhibit a lower degree of these abilities are placed low in the scale of intelligence. (iii) A relative valuation of racial intelligence is more generally attempted by accepting the performances of a race in a particular direction as the standard of measurement for the performances of other racial groups. The British people and the Germanic 'race' often set themselves up as standards against which other peoples are to be measured. A racial and political narcissicism is the principle of evaluation in these instances.

Such estimates must necessarily be uncertain on account of the variability of the scale employed. A more precise standard has been used in recent years for measuring intelligence of racial and other groups, in the shape of mental tests. The data in these cases represent the observations of trained workers under well defined conditions. And the tests themselves are calculated to bring out the *general* ability which is native, rather than *special* types of skill acquired by training. If a racial group

exhibits a specified order of general intelligence-value, one may with reason accept the notion of a certain level of intelligence specific to the race.

It is not possible to test all the members of a racial group. The persons tested must then be *representative of the group*; they must be *fair samples* of the group. No race, however, consists only of people of high, low or mediocre intelligence; it takes all sorts to make a world. Racial intelligence, therefore, is mainly a statistical conception worked out from the intelligence scores of the samples actually tested.

It follows, then, that the larger a racial group, the more varied its economic and cultural strata, the more difficult it is to represent its intelligence-values by a single set of figures. These considerations subtract from much of the assurance that we may be inclined to feel in regard to an estimate of the intelligence of a given race. The question of inheritance of intelligence, then, becomes more or less a general belief. It is not capable of definition or demonstration in any strict sense of the terms.

§ 2. *The Order of Merit in Intelligence Among the Population of European Stock*

The War of 1914-18 made it necessary for the United States to recruit a large army which comprised almost all the racial elements of Europe including Turkey. The military authorities thought it necessary, in the interest of efficiency, to subject the recruits to a battery of intelligence tests. This procedure, it was hoped, would secure the services of the more intelligent section of the population. The process of training the new entrants into a fighting body would, in this way, be made easier.

Other things being equal, a racial group would have a higher score of intelligence or I.Q. than another group to the extent that it possesses fewer persons of low I.Q. For, the I.Q. for the group will represent the people both of high and low I.Q. Judged on this basis the various

European racial elements dwelling in the U.S.A. and enlisting for the army, can be arranged in the following order : 1. England, 2. Holland, 3. Denmark, 4. Scotland, 5. Germany, 6. Sweden, 7. Canada, 8. Belgium, 9. Norway, 10. Austria, 11. Ireland, 12. Turkey, 13. Greece, 14. Russia, 15. Italy, 16. Poland.

It is clear from the nature of the situation in which the tests were administered that the racial elements in this case were not fair samples of the race-groups. Nor did all of these represent similar social and cultural strata of the races in question. The British and the Dutch elements represent the older inhabitants of the Continent and usually belong to the more successful section of the population. In a war of Great Britain against Germany, the better elements of the English and the Dutch stock would naturally come forward. At the same time, only the less fortunate section of Germans would come for enlistment. The better class of the German-Americans were either anti-British or anti-war. Since the recruitment was voluntary, there was no need for any racial group to contribute its fair sample.

Moreover, most of the emigrants represent the less fortunate section of a country's population. They and their descendants belong to the lower grades of intelligence and ability even in their own country. Hence, the data do not in any way indicate racial intelligence. It is merely a statistical formulation of the I.Q.-values of the various groups actually tested.

Other attempts have been made to base the conception of racial intelligence upon a study of the I.Q. of school children in the United States. These come from the various European stocks though they dwell under similar cultural conditions. Spearman quotes the following data :—

TABLE I.

Countries.	No. of cases.	Median I.Q.
Norway ..	34	103
England ..	90	102
Germany ..	67	102
Sweden ..	187	102
Austria ..	28	99
France ..	199	95
Finland ..	226	90
Slovakia ..	31	86
Italy ..	51	77

Berry has computed the percentage of children of the higher of the three grades into which the I.Q.-values were classified. The racial division is given in the following table after Spearman :

TABLE II.

Countries.	% of Superior Pupils.
England ..	29.8
Canada ..	29.6
U.S.A. ..	28.7
Germany ..	25.2
Various other countries	16.1
Russia ..	15.4
Poland ..	9.0
Italy ..	6.1
Remaining other countries together ..	16.1

These studies are subject to the same objections as those urged against accepting the scores of tests applied to recruits as norms of racial intelligence. As Spearman remarks : "We need still to know how large these per-

centages in the constitution of the groups are as compared to those in the general population whence the group was taken" (1). If, then, we are not sure about the representative character of the I.Q.-values, the question of inheritance of intelligence does not arise so far as these studies are concerned.

§ 3. *Intelligence of Definable Race-groups*

Small racial groups are sometimes isolated from the main body of the population, on the hills and distant valleys, on islands and oases of the desert. It is possible to study the successive generations of children to see how far the intelligence of one generation stands in relation to that of another generation. This line of study which would be so valuable for the estimation of racial intelligence has not, however, been undertaken with such ends in view.

The study of racial groups placed together in certain regions may open another avenue of study. There are, in certain parts of northern Bengal, two different elements of population. One of these consists of the regular inhabitants of the plains, belonging to the same caste groups as the rest of the population and possessing physical features similar to the rest of the population. There is also another racial element peculiar to the region. They form a caste-group, belonging to the Hindu fold, peculiar to this region. To whatever religion they may be affiliated, they present strongly Mongolian features. A comparative table of the percentage of aggregate marks representing achievements in the various subjects studied at school is given below.

(L means local group that properly belongs to the region. P means the population that properly belongs to the plains. A and B mean two schools belonging to different regions. Only the best or the ten highest aggregates of each group are considered. The figures represent percentages.)

TABLE III.
Data obtained in 1917-18.

Age groups : School record	A		B	
	L	P	L	P
10 — 11	48.7	50	52	51
11 — 12	43.5	49	54	50.5
12 — 13	33	56	42	55
13 — 14	28	62	32	60

TABLE IV.
Data obtained in 1927.

Age groups : School record	A		B	
	L	P	L	P
10 — 11	51	50	54	55
11 — 12	46	48.2	53	52
12 — 13	36	55	46	53
13 — 14	38	61	37	55

The main point of interest in the data is two-fold :
(i) The P-group shows in both the schools a slightly better record of achievement. This, however, can largely be explained by the phenomenon of "*linguistic lag*", a certain deficiency in acquiring new languages, classical and foreign, on the part of the L-group. Since both of these are subjects of study in the schools in question, the small difference between the L and the P groups can easily be explained. (ii) But the L-group shows a marked deterioration with the increase of age towards puberty. This phenomenon is found in both the schools and in both the periods under consideration. Such a decline exhibits a special feature in the *tempo* of intellectual growth.

The difference between the intelligence of the two groups, then, may not be large. But the profile of growth of intelligence shows characteristic differences in the two cases. In the case of the P-group, the curve of achievement has a slight rise with the increase in age. In the case of the L-group it exhibits a sharp decline.

A somewhat similar phenomenon is observable in other regions. The following table gives the average percentage of aggregate school marks of the best five pupils belonging to the Hill stock and the Plains stock in the Doon Valley :

TABLE V.

Type of Pupils.	Age-group 13-14 % of marks.	Age-group 15-16. % of marks.
Hill	49	36
Plain	53	53

A deterioration in the intelligence of age-groups nearing puberty is noticeable in this case as in the previous instance.

A study of the I.Q.-values of the North Georgia mountain people in the U.S.A. likewise exhibits a deterioration with the increase of age. The population in this instance, however, is said to belong to the same racial stock as the people of the plains. They are mainly of Anglo-Saxon ancestry though there is a small percentage of Scotch-Irish, German, French and Red Indian blood. The Anglo-Saxon character of the people is specially brought out by the language which resembles 18th century English. The following table represents the phenomenon :

TABLE VI.

Age-groups	No. of Cases.		Median I.Q.	
	Kentucky	Georgia	Kentucky	Georgia.
7 year	113	8	85	108
8	180	14	81	100
9	179	27	79	98
10	190	41	78	94
11	191	55	77	95
12	211	42	75	92
13	177	21	73	97
14	174	23	74	76
15 up	422	16	81	70

The phenomenon of decrease is clearly observable in this series of data (2).

The difference in the excellence of academic achievement between the children of the mountain stock and those of the plain may be variously explained : (i) It may be due to the importance that the social scheme of each group gives to school education. It may be due, thus, to neglect and apathy in one case and encouragement in another. (ii) It may be due to the economic stress that compels the abler children of a race-group to begin to earn their livelihood earlier. The more fortunate, but not necessarily the more intelligent section, is thus left in the schools. (iii) It may be due to inheritance of a certain type of ability from the racial ancestry. The third hypothesis, however, is but one of the alternatives. Each of them requires more crucial instances for its verification or disproof.

The *inverse relation* between age on the one side and the school achievement and I.Q.-values on the other may similarly be explained on the basis of several alternative hypotheses : (i) It may be due to the social and economic fact that as the boy grows up he is compelled to earn his living and leaves the school. The best and the most enterprising element may not be represented in the school. This view, however, is not sufficient to explain the general tendency in the different regions of India and U.S.A. (ii) It may, in the second place, be due to a greater degree of puberty-disturbance that causes intellectual backwardness. This hypothesis, too, does not meet all the cases; for, the deterioration seems to set in much earlier than the period of puberty. (iii) Lastly, it may be due to the inheritance of certain psycho-physical traits that determine the profile of intelligence. Such inheritance may be intensified through inbreeding in these small groups. This view is highly speculative, but it largely corresponds to the data.

The general conclusion of this section, then, is as uncertain as that of the previous section. The data suggest inheritance. They are not sufficient to verify the

hypothesis that there is a heritable racial intelligence in the biological sense.

§ 4. *The "Whites" and the Negroes*

The Whites and the Negroes in the U.S.A. present a sharp contrast in racial features, social conditions and political status. At the same time, they live under a similar physical, economic and educational *milieu*. The differences caused by the racial and other factors, then, are reduced to a minimum, so far as they can be so reduced, under the conditions of ordinary life. A comparison of the data obtained from the administration of tests of recognised validity, would be likely, then, to bring out the difference, if any, between the intelligence of the racial groups.

A large number of studies has been carried through by competent workers during the last twenty-seven years from 1913. The following table gives the results of some of the studies surveyed by Graham (3):

TABLE VII.

Year	Worker	Tests	No. of Negro cases.	Findings.
1913-14	Strong Morse	Binet	120	<i>Retardation:</i> N 29%, W 10% by one year. <i>Advanced:</i> W 5.3%, N .8% by one year or more.
1914	Phillips	Binet	58	N — M.A. .7 yr. below C.A. W — M.A. .17 yr. above C.A.
1921	Arlitt	Binet	71	Med. I.Q. N. 83, W. 106. Diff. bet. N and W of the same social status .09 in favour of W.
1923	Peterson	Pressey	734	N. I.Q. 75
1923	Peterson	Otis	115	Med. N. I.Q. 57
1923	Peterson	Haggerty	37	N. I.Q. 92
1926	Wang	Ohio	44	Slight N. inferiority.

(N=Negro, W=White. I.Q.=Intelligence Quotient.
M.A.=Mental Age. C.A.=Chronological Age).

It is manifest from the survey presented in the table that there is a definite inferiority of the Negro with respect to intelligence. Yet, a voice of dissent and caution is heard even with respect to data of this type. Bagely, in reviewing the results of the army tests and the persistent suggestion of Nordic superiority in intelligence says that though army tests are reliable as measures of difference in native intelligence in groups homogeneous in the matter of educational opportunities, "they have no reliability whatsoever as measures of intelligence levels" of large and heterogeneous groups (4).

There is always a distinction between strict proof and a *prima facie* case. Although a strict proof in regard to the exact difference between the I.Q.-values of Whites and Negroes may not have been worked out by the long line of workers, it would be unreasonable to insist that the difference is non-existent. We may also take account of another aspect of the question. The gradations of I.Q. may not indicate a graded scale of intelligence-values. It may not be able to establish a hierarchy of intelligence along racial lines as suggested by the data of Section 2. The racial groups that give in considerable proportions a low range of I.Q.-values, for instance quotients of 80 and less, raise a strong presumption of intellectual dullness, if not of sub-normality. The results cited in this section lead us at least to this conclusion.

It is not unusual to discover a larger number of dull persons in one section of the population than in another. Such prevalence of 'dullness' would lower the average of the racial I.Q. In your practical life you would not expect to find a larger number of persons of high intelligence in such groups. It would not, however, necessarily entitle one to say that there is something in the racial blood that contributes to a lower level of intelligence. The problem of racial inheritance of intelligence, therefore, is not solved by these lines of enquiry.

§ 5. *Racial Physique and Intelligence*

Attempts have been made in recent years to discover the amount of correlation obtaining between certain physical elements that define a race-group and I.Q.-values. Such efforts have often yielded results that can be explained without the assumption of inheritance on racial lines.

The study of hybrid groups has often been adopted as a method for approaching the question of racial inheritance. Garth, Schulke and Abell have studied the scores of the National Intelligence tests applied to 609 mixed-blood and 89 full-blood Red Indians. They found that the intelligence scores increased as the amount of Red Indian admixture decreased.

TABLE VIII.

Amount of Red Indian Blood.	Nat. Int. Test Scores.
$\frac{3}{4}$	74
$\frac{1}{2}$	75
$\frac{1}{4}$	77.5

The correlation between the amount of white blood and Test scores was found to be $+.42$. But a further analysis was made by the authors on the basis of school-grades representing the amount of schooling. It was found that the co-efficient of correlation did not remain constant with the same degree of white blood. It changed in the different grades of the school. The following table gives the data:

TABLE IX.

School Grades.	No. of cases.	Correlation.
IV.	134	.70
V.	169	.76
VI.	180	.22
VII.	112	.23
VIII.	75	.24

The data suggest, according to Anastasi, that "in the lower grades those children with a larger percentage of white blood clearly excelled their fellows. In the upper three grades, however, the relationship is very low and barely significant. Thus continued education in a common school seems to reduce and even wipe out the apparent effects of Indian blood" (5). The evidence concerning the contribution of schooling has not yet reached a point of complete unanimity (6). Intelligence as a trait is commonly supposed to remain fairly constant. Yet, the data at hand suggests that nurture also makes a large contribution. Burt, upon an analysis of the data yielded by the Binet-Simon tests, apportions the contributions of the various factors in the following way :

Age and maturation ..	$\frac{1}{9}$	(7)
Intellectual development	$\frac{1}{3}$	
School attainment ..	$\frac{1}{2}$	

It is not possible, therefore, to define intelligence in terms of biological inheritance in the general sense, in terms of "racial blood". Other attempts to relate intelligence test scores with specific physical traits yield more uncertain conclusions, as the following tables, based upon the works of Peterson and Lanier, will show : (8)

TABLE X.

Correlation between lightness of skin and mental test scores in groups of 12-year old children :

Tests.	No. of cases.	Correlation.
Binet Group tests ..	83	.18
Myers Mental Measure	75	.30
Rational learning, Time score ..	117	.05
Mental Maze, Time score ..	113	.14
Disc Transfer, Time score ..	119	.39

TABLE XI.

*Correlation between the scores of Yerkes' revision of
Binet scale and certain Physical measurements :
Subjects : 75 Negro School Boys :*

Traits.	Correlation.
Nose width ..	— .11
Lip thickness ..	.07
Ear height ..	— .15
Inter-pupillary span ..	.01
Composite of these four traits ..	— .13

Another study made by Klineberg on the correlation between the scores of the Pintner-Paterson scale applied to 139 Negro boys of the age-group 7-16 and certain physical traits serve to confirm the foregoing results:

TABLE XII.

Traits.	Correlation.
Nose width ..	— .083
Lip thickness ..	— .068
Black pigmentation ..	— .12

A consideration of these studies in the correlation of certain Intelligence Test scores with physical features more or less precisely defined, does not support the hypothesis of inheritance of intelligence as a racial trait. The visible features that distinguish one racial group from another, do not seem to bear upon intelligence; nor do the general physical make-up and inheritance, usually subsumed under the broad conception of 'racial blood.' The hypothesis of a racial level of intelligence and its inheritance, then, are not verified by the results of studies so far carried on.

§ 6. *General Conclusions*

(i) A racial group as a biological reality cannot easily be separated from its economic, social, educational

and political setting. Beliefs and even observations in regard to racial differences in intelligence, presuppose a variety of contexts. The determination of a well-defined norm of intelligence which holds true in all the contexts has not so far been possible. The political and economic achievements of a race may not correspond to the standard of its contribution to culture, literary, scientific and philosophical. The estimate based upon one epoch of racial history may be at variance with that based on another.

For instance, Renan, whose view is quoted in a later chapter, calls the Jews an "*incomplete race*". "Ils ont été assez mal doués pour tout ce qui touche à la culture scientifique." They are inadequately endowed to pursue and contribute to scientific culture. Yet, the great eminence of Jewish scientists of the present time belies Renan's *obiter dicta*. Further, the Jews were said to possess no philosophical equipment. It needs only a glance at the history of philosophy and a survey of contemporary thought to refute such a statement. The context of such a judgment lies in the political ineffectiveness of the race. "They have neither a political life nor military organisation," thus, the intellectual ability of the Jews is placed at a discount (9). The trait, the inheritance of which is in question, remains undefined. Or else it becomes relative to the point of view. The hypothesis of its inheritance cannot consequently be verified.

(ii) Tests that are formulated and standardised under one set of social and educational condition cannot readily be applied under another. The comparison of the I.Q.-values of races living under different social and cultural conditions becomes, for this reason, difficult. Further, if Burt's view that schooling contributes more than half to the score be correct, the comparison of the I.Q.-values of races living in the same country but under different socio-economic conditions, becomes uncertain.

(iii) Certain residual differences may be found between racial groups in spite of the objections noted

above. The test data seem to bring out certain differences with respect to the G-factor as between racial groups. Such differences, however, are said to be very small in amount. They are much smaller than the differences that subsist among the members of the same racial groups (10). Thus it is not possible to define I.Q.-values specific to racial groups. The hypothesis of inheritance of racial intelligence, therefore, cannot be verified (11).

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CHAPTER XI

RACE AND CHARACTER.

§ 1. *Introductory*

The concept of 'Race' has long been employed for political purposes. It is supposed to represent a tie of blood between millions of people. The war-cry has so often gone forth calling certain classes of people to arms in the name of the 'race'. The Germans summon all 'Germanic' races to follow the leader ; the Pan-Slavic, the Zionist and the Pan-Arab movements have appealed to certain peoples to unite and to fight in the name of the common racial culture and inheritance.

These appeals have their counterparts in the life history of smaller groups. The "blood-feuds" of the medieval clans lend materials to history and romance alike. The tales of heroism of the Rajputs have their setting in the conception of blood-feuds and of the common tie of blood among the people of a state. As we trace the idea back to primitive societies, we come upon the concrete sense of kinship that underlies war and peaceful alliances, marriage and religious worship.

The concept of 'race' has been employed to rouse a sense of racial superiority and racial patriotism. The western world has long been dominated by the idea of a higher destiny for the race and by an almost universal sense of superiority in relation to other races. This superiority has been supposed to be shared by virtue of inheritance even by the most unworthy individuals of the race. The Germans during the present century have been obsessed by the idea of racial superiority upon which they have based their political programme, internal and external. Every German claims to inherit the Germanic

qualities by virtue of his German blood. For instance, the Germans in recent years have sought to nurture their racial arrogance by a contrast with the Jews and by identification with the ancient Aryans. The Jews are regarded as the repository of all that is mean and ignoble and are, therefore, considered as fit subjects for persecution. The Germanic culture that the Jews manifestly imbibe does not influence their character or the direction of their intelligence. For, these depend on the "*blood*."

The concept of racial ability and intelligence represents in this manner a blend of political and biological notions. One supposition is called upon to support the other. Even field-surveys and tests applied in recent years have been considerably dominated by the bias that political ideas have incipiently induced in the mind of the scientist. The analysis of the phenomenon of inheritance in this field has to proceed on the basis of data about the scientific impartiality of which no one can be sure.

Over and above this fact, the very conception of race has become much less precise. It is very difficult to say how far any so-called race, Anglo-Saxon, German or French, represents a pure biological stock. These have grown in dominance not as races but as *nations*, and *nations* carry the contribution of many racial stocks from days long gone by. Hence, the so-called race becomes a social and political concept with a very indefinite biological basis. The concept of inheritance in this context must, then, be accepted with great caution (1).

§ 2. *Early Marshalling of Data*

Early conceptions concerning inheritance of racial character and intelligence ran along lines of broad speculation and large generalisation. Ribot quotes from Caesar's commentaries and the works of Strabo and Didoro to show how these ancient writers attempted to

sum up under a few concepts the racial character of the Gauls. Thus, the Gauls are said to possess a love of warfare, a taste for all that glitters, suppleness of mind to an incredible degree, incurable vanity, and a great fondness for talking and playing with words. They are also said to be fond of revolutions, to be led by false cries, and to lend themselves to actions that they regret in the end.

Similar speculations have been recorded in later times in regard to the character of certain other races. According to Laycock, for instance, the Magyars love to dwell in the plains in response to a racial impulse that they inherit from their ancestors, the Huns, who dwelt in the plains of Central Asia. They differ in this respect from their neighbours, both Slavs and Germans. The gypsies, likewise, are said to possess a well-defined pattern of mental traits. They are, according to Birow on whom Ribot depends, light-hearted and frivolous like children. The stream of things and events pass by without producing any lasting impression upon their minds. They are ever-ready to abandon themselves to the hazards of life into which fugitive emotions lead them. Everything for the gypsy is thus in a flux. He does not choose to build in this world of perpetual change a durable abode either for his body or for his mind. The outlook, temperament, volitional disposition and framework of ideas persist, though the gypsy dwells in a world where mighty civilisations rule. The peoples through whose lands they pass do not touch their inner nature. The environing races are simply the sources from which they are to draw their sustenance by their deftness of finger and mental agility. The whole pattern of traits, then, has come down to the gypsy from his remote ancestors in the far off lands.

The Jews as a race are supposed in the same manner to possess hereditary abilities and disabilities. They have produced a very large number of persons with great musical ability, an ability which, as we have seen in a previous chapter, may be regarded as a heritable trait. They give evidence of a highly developed capacity of

imagination and a finely filiated life of sentiments. These, it is said, make it possible for the race to contribute so nobly to creative work in the fields of religion, poetry and music.

But the Jews have their peculiar disabilities, the analysis of which led Renan to call them "*an incomplete race*." They have, it is said, no plastic art, no science based on reason, neither philosophy nor political life, nor military organisation. The concepts of aristocracy, democracy or feudalism have no meaning, according to Renan, for the Semitic people. Their military inferiority arises from their incapacity to submit to discipline and organisation.

Monsieur de Candolle, quoted by Ribot, however, gives a better character to the Jews. They are, he says, diligent, intelligent, economical sometimes to the point of avarice, charitably disposed, averse to violence, not given to crimes against persons, or to drunkenness. Europe, inhabited principally by Jews, would have presented a very different picture, in the opinion of the author quoted. There would have been no war and, consequently, millions of people would not have been snatched away from their useful labours in various fields. Public debts and taxes would have diminished. Industries and commerce would have flourished and all forms of culture, sciences, arts and especially music, would have been developed much farther than they are now.

The mental traits that underlie these abilities, maintain themselves under diverse schemes of culture. The Jews live in groups, large or small, in Germany, Russia, Rumania, France, Holland and England always exhibiting similar patterns of culture and abilities. These small groups, in order that they may resist the intrusion of other culture-schemes, must possess certain mental traits that build a protective coating round their life and activities. The group life, then, maintains a continuity irrespective of the environment and the diverse social forces that play around it. Such continuity of a pattern of traits implicates inheritance in some form.

The Jews are mainly an endogamous community. Social and biological inheritance are confined in this way within the bounds of the community. Aptitudes and failings are both increased in their degree, as usually happens in the case of marriage within the limits of consanguinity. The Jew thus owes his many abilities to his rich racial inheritance. But close endogamy with a consequent circulation of blood within a narrow social group has its penalties. Ribot cites facts to show that the Jewish race in every country has a large number of deaf-mutes and people with mental infirmity. There is, likewise, a considerable number of aments among the Jews. These defects are recognised to be heritable. The same type of union that favours the inheritance of diseases and infirmities also restores the social balance by endowing the racial group with traits that combine into great abilities (2).

§ 3. *Early Attempts at Interpretation*

A mental quality is not possessed to the same extent by all the members of a racial group. All the Jews are not equally musical. All the Hungarians are not equally fond of plains. And all the gypsies are not engrossed in their subjective life of images. At the same time other racial groups too possess these qualities to a greater or less extent. The Germanic and the Slavic groups that live in close proximity to the Magyars, have exhibited their love of plains whenever they have found a profitable one to settle in. There have been non-Jewish exponents of high music in plenty, and even gypsies have been known to marry and settle down.

The qualities of Jews, Hungarians and gypsies mentioned in the preceding section are found in varying degrees in the several racial groups. The characterisations and the descriptive concepts, then, represent linguistic translations of vaguely perceived averages. Unlike the true statistical averages they are not given numerical values, and they are not corrected by their measures

of error. The data reported in the preceding section, then, are more in the nature of *opinions*.

But even opinions should be supported by something other than their mere assertion. Attempt is thus made to provide these views with a kind of theoretic basis. Theories and interpretations are formulated in order to supply a rational basis for opinions based on observation more or less adequate. Candolle, whom Ribot quotes with approval, says: If heredity did not play any part, there would be no perceptible difference between infants and youths of different countries. Nothing, however, is more strange to observe than a gathering of little Italians and little Germans. The former have an alert appearance, great vivacity and a singular aptitude to seize upon what is taught. The latter are calm and serious, and possess a great capacity for application. The difference between the children is perhaps much greater than among the adults. Inheritance, unaffected by nurture that modifies its effect, is thus the obvious explanation of the phenomenon.

Laycock tries to carry the analysis to psychological factors. It is more than probable, he says, that certain vague states of pleasure or of pain arise on account of a reversion to the ancestral condition. These states cannot be clearly defined or perceived; but they occasion a well-set attitude of likes or dislikes for certain objects and situations, as in the case of the ancestral stock. Thus the descendants of mountain dwellers find satisfaction in high altitudes; the children of those who have long dwelt on the plains or on the river, derive an unaccountable sense of joy in these settings. It is not necessary that these external situations should be beautiful or should possess elements likely to yield pleasure. Satisfaction arises from the law of habit, of racial habit (3).

Laycock's conceptions of 'vague pleasure and pain', reversion to ancestral conditions and of set attitudes towards classes of things, are indefinite in character and possess almost a mystic significance. The world of psychology has, however, by no means outlived these

interpretations. Jung's theory of the racial unconscious leads us back almost to the same level of thinking. We have to reconcile ourselves to the unconscious striving of the libido, to fixations of desires to things and situations that cultural life conceals in symbols which retain their identity amidst the vicissitudes of racial history, and to the perpetual renewal of the same imagery, of the same myths that satisfy certain undying urges of life and mind trailing back to the origins of the race (4).

The conception is magnificent and poetic. It also serves to interpret certain uniformities in imagery and myths that recur in the racial history in spite of vast cultural diversities. Yet it is a conception which is difficult of precise definition. It implies a continuity of the racial unconscious to which it is impossible to attribute a psycho-physical vehicle.

Freud also condenses the racial likes and dislikes, the moral and social judgments, in short, the racial conscience, into the super-ego. But he does not try to set it up as an entity or as a psycho-physical reality that harks back to the racial beginnings in a biological or metaphysical sense. It is more likely a product of the social forces that perpetually modify the impulses constituting the personality. This conception of Freud, then, though parallel to that of Jung, is less poetic, more naturalistic and therefore more precisely definable. It does not, however, necessarily implicate the notion of racial inheritance (5).

Ribot attempts to interpret racial character in terms of set modes of mental activities and beliefs that find expression in behaviour and institutions. His analysis of the phenomenon under discussion is summed up by him in the following manner :

- (i) Success and failure of peoples in their cultural, economic and political endeavours depend largely on their institutions.
- (ii) Institutions depend upon racial habits, conventions and religious beliefs.

- (iii) These latter in their turn rest upon the sum-total of the persistent mental and behavioural tendencies that we call character.
- (iv) Character is grounded, in its ultimate analysis, upon a complex set of psychological and physiological functions that are subject to formulation in the shape of laws.

Ribot stresses the principle that in the spheres of politics and social affairs, causes and effects are not arranged in a serial order as in the case of physical events. There is always a reciprocal relation between causes and effects. The psycho-physical tendencies coalesce into character; and the latter exercises a determining influence upon the former. Character gives rise to institutions; the latter, again, form the character. The subjective and the objective processes are merely the phases of a total configuration. "Les institutions l'étant que le caractère rendue visible et permanent" (6).

It is apparent from the foregoing analysis that facts of racial character as well as their principles of interpretation are conceived in too general a manner. Facts with indefinite connotation, properties and boundaries, hardly lend themselves to precise scientific treatment. It is not possible to say whether a racial ability is heritable or not when its nature remains a matter of opinion. When the analysis of the ability leads us into processes that are unknown or incapable of definition, we are in a greater difficulty.

A definition of facts becomes more precise to the extent that it can be quantitatively stated. The defect of these early speculations lay in that no method was available for quantification. The growth of laboratory technique in psychology and of tests, brings a quantitative statement of traits and abilities within the range of possibility. It becomes possible, therefore, to compare a given trait of a particular generation with that of the ancestor stock and of other racial groups in a quantitative form. The presumption of inheritance is in this

manner more directly proved or disproved. This is the type of study which has been undertaken in recent years.

§ 4. *Some Recent Attempts at Rating Racial Character*

Human responses are very largely *learned responses*. The native equipment of behaviour-patterns is overlaid by what the organism acquires in the course of its nurture. It becomes difficult, therefore, to assess the true value of what the organism inherits in the shape of behaviour-patterns and mental abilities.

Let us take the phenomenon of emotion which is a normal equipment of human mind. Any test of emotion by the variants of the *methods of impression and expression* would involve the presentation of a situation. When emotional reactions of a people are recorded in a field investigation, the occasions are carefully noted. But the stimuli and the occasions have different exciting values upon different racial groups. A race that boldly faces a bear or a tiger shakes in fear before a toad. A people that boldly fights in a bloody battle is entirely unnerved by the actions of a sorcerer. The same scale of tests cannot measure the emotion value of different races.

A new and a happy concept, "Cultural neurosis", has been suggested in view of this fact. The cultural history of a race often prompts it to give an exaggerated response to a stimulus that leaves other racial groups unperturbed. Since all exaggeration of emotions is regarded as a sign of neurosis, the phenomenon in question is called "Cultural neurosis" (7). Such 'neurosis' makes the comparison of relative emotivity of races difficult if not impossible. For, the susceptibility to particular orders of emotions is interlaced with the culture of the race. Since emotions constitute a basic element of the structure of character, it becomes difficult to describe the racial character in the manner in which it has been done in the past and is still being done for the purposes of propaganda.

A study directed to children's spontaneous drawing, is calculated to bring out the characteristic features in imagination. A group of 159 Red Indian children were tested in British Columbia. Half of these belonged to the *Kwakiutl* tribe, and the rest to the following five tribes: the *Nass River*, *Bella Bella*, *Haida*, *Tsimshian* and *Bella Coola*. The authors state that there is no marked difference between the children of one tribe and those of another. The reason is not far to seek. All the tribes live practically in the same environment. The art forms of the tribes do not differ in any considerable degree, and all the children attend the same school. It is suggested then that imagination does not proliferate in different forms in spite of tribal inheritance. The influence of the environment holds sway.

In spite of this the authors point out : "An Indian child of the north Pacific coast when directed to draw an animal, may produce a *symbolical* representation rich in details which it would be futile to evaluate in terms of norms established elsewhere. The fact that in response to the request to draw an animal, some of the children drew mythical creatures, is itself significant and quite unlike results which would be obtained under similar conditions in children in our own culture." (8) The facts brought out in the study and their analysis, however, do not lend support to the conception of a specific tribal character so far as autistic imagination is concerned. It does not, thus, support the theory of inheritance so far as this factor is in question.

§ 5. Conclusion

The conception of a racial character as a *heritable quality* finds but slender support from logical analysis or observation. It is not our intention to deny the existence of particular types of emotional tendencies, specific patterns of impulses and modes of behaviour characteristic of races. These develop in the course of mutual adjustment of individuals in a group, through the impact

of institutions upon the life of the individual, and in the course of the various forms of economic and political adjustments. There is undoubtedly something that the members of a racial group inherit from their ancestors. But it is so much obscured by social and other environmental factors that it is impossible to speak of a racial inheritance as a fact which can be ascertained by scientific observation.

The psychological reasons for this conclusion are not far to seek. Character depends largely on the manner in which individuals and groups emotionally assess any given situation and on the manner in which they tend to respond to it with the least amount of training. The direction of attention and the trend of associations follow the lead of the emotion-behaviour pattern. But emotions assume strange shapes, as the studies of the psycho-analytic school have shown. And the behaviour forms must necessarily adapt themselves to the situations that arise in the course of economic, political and social efforts. Hence, racial character would undergo transformations, large and small, with the nuances of emotions and impulses. What is truly inherited is overlaid by what settles upon the group-life in its contact with the environment, social and physical. The assessment of racial inheritance in this sphere becomes, thus, a matter of opinion and often of prejudice and bias.

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CHAPTER XII

IMPULSES, DISPOSITIONS AND PERSONALITY-TYPES.

§ 1. *Introduction*

Man's mental personality possesses numerous undefined functions, tendencies and traits. Most of these pass unnoticed as components of mind by the individual himself and by other observers. Yet, the same functions when they are exaggerated or when they appear in peculiar combinations, have a marked influence upon a person's adjustments to his normal milieu, social and physical. These are usually subsumed under the general concept of "*personal peculiarities*".

It is often found that some of these '*peculiarities*' characterise a number of persons belonging to a family. We come to conclude from this fact that there is something in the "blood" that produces the traits in question. We do not usually make any attempt to define the feature the inheritance of which we so readily assume. Nor are we called upon to analyse the lines along which the postulated inheritance is supposed to be handed down. The provisional hypothesis passes into a popular belief; and we confidently assert that X cannot but be a drunkard; for, 'blood tells.'

The present chapter will be given to an analysis of the theories of inheritance of mental traits of this description. Some of these represent but exaggerations of normal functions. Others represent patterns of mental processes, or the mental background upon which specified functions appear. There are still others which become significant, not as specific psychic tendencies but as something that serves to impose a particular stamp on the per-

sonality as a whole. Proclivities and passions, temperaments and personality-types are the factors, the evidence for the inheritance of which we shall consider in this chapter.

§ 2. *Early Speculations*

Speculations concerning the inheritance of these characters have long been in vogue. Montaigne speaks of a 'strong antipathy towards medicine' running in his family. Gall, Huss and Morel narrate instances of strong inclinations towards alcoholism that prevail in certain family groups for several generations. Most of these observations are subject to two principal defects: (i) They do not adequately consider the influence of nurture. For instance, Buzareingues, whom Ribot quotes, cites instances in which the taste for drink is said to have been transmitted through the mother. The obvious fact that the mother is often the chief medium of training is not given adequate weight. The hypothesis of inheritance in such cases rests, therefore, upon uncertain foundations. (ii) Secondly, the materials that form the basis of these studies are gathered mainly from anecdotes concerning persons and families (1). The phenomena of exaggeration and underestimation of facts in the medium of gossip are well-known. The data collected by this method hardly ever lend themselves to precise treatment as would be demanded in the solution of the problem of heredity. A survey of this phase of the question, therefore, does not carry us far in our enquiry.

Ribot's work on heredity of mental traits (*L'Hérédité Psychologique*) appeared under the stress of early enthusiasm roused by the doctrine of evolution (1871-72). He draws pointed attention to the rôle that the various tissues of the body and their functions play in the mediation of inheritance. The general scheme of Ribot's theory thus lends itself more easily to the interpretation of hereditary transmission of the traits that we are considering.

The author begins from the observation that animal behaviour takes to family types. Hunting dogs and race horses are selected on the basis of a large number of behaviour-traits that can be subsumed under the concepts of temperament and disposition. Steadiness in the speed of the horse and the dog, their reactions to punishment, their behaviour in the company of others of their kind, and persistence of goal-orientation, are some of the functions that enter into the selection of these animals; and all of them can be aptly placed under the categories of temperament and disposition.

But these traits are also said to depend upon the pedigree of the animals. In fact, a great deal of importance is attached to the pedigree of dogs and horses, more perhaps than in the case of human beings. It is unlikely that a person given to hunting and racing will purchase a dog or a horse of unknown pedigree. It is quite common for the same class of individuals to marry women of unknown or uncertain pedigree.

The lessons learnt in the selection of dogs and horses, then, should also be applied to human beings. Here, too, some evidence of the influence of inheritance is not wanting. Galton mentions the case of those who win olympic games. He suspects that heredity plays the same rôle in these instances as in the case of the racing horse. The athletic prowess and the physical qualities that underly them, seem to run in families (2). In the same way Ribot argues that since each animal has a voice or sound peculiar to its species, the qualities of voice implicated in singing and oratory may also be supposed to be inherited. The same suggestion is made in regard to dancing (3).

These abilities, however, implicate more than their muscular components. They presuppose a particular type of psychic *Anlage*, a temperament and a disposition that are essential to them. Hence, a successful selection of persons for boxing, marathon racing or singing, involves the selection of a disposition that contributes to the success of the athlete or the musician. If athletic

ability runs in families, as is suggested, the disposition and the temperament, too, should be believed to be a family trait, and hence presumably hereditary. Such is the array of facts of normal life that lies at the basis of belief in the inheritance of dispositions.

§ 3. *The Evidence of Exceptional Traits*

Ribot attempts to strengthen the case in favour of inheritance by the evidence of a number of rather rare proclivities and desires that certain persons display. It is claimed that these rare traits usually run in families. The conclusion suggested from such distribution of the traits is that they are hereditary.

(i) There are many families that exhibit an almost irresistible desire for alcohol. There are others that manifest a craving for opium. Ribot cites other instances in which certain drugs produce effects contrary to those normally to be expected. For instance, opium in certain cases is said to induce convulsions. Coffee, likewise, is said to induce sleep. Certain types of food-antipathy and strong repugnances for insects, vermin and even social situations, are said to have a distribution along family lines. But these impulses and antipathies have their setting in certain types of temperaments and dispositions, in certain sentiments. If the former are inherited, the latter too should be supposed to be transmitted in the same manner.

(ii) The exaggeration and distortion of certain normal appetites are said, likewise, to mark out certain family-groups. In addition to the craving for drink which has been mentioned above, there are certain families which manifest an excessive tendency to eat. Ribot cites the case of Louis XIV who exhibited voracity to a remarkable degree. It is said that all the children of the king were gourmands and great eaters.

Geophagy, the proclivity to eat earth and earthenware, is not uncommon among women and children of the tropical regions. The negroes of the Guinea region,

even when they were sold as slaves in the U.S.A., were found to possess this proclivity. It is suggested that these inclinations must necessarily have a background of dispositions and temperaments, and that the entire constellation of impulses and their background is transmitted by heredity.

The same thing is true of sexual proclivity. The case for its inheritance is supported by the study of a number of family groups well-known in history—the instances of Auguste and the two Julias, of Agrippine and Nero, of Marozie and Benoit IX, of Alexander VI and his children. Lucas, from whose writings Ribot quotes, gives instances in which children, separated in their early life from parents with abnormal sexual passion, were found to be subject to the same type of aberration. It is suggested that the growth of sexual passion with a high degree of intensity and marked by tendencies to perversion is determined by heredity (4).

§ 4. *Ribot's Theoretical Formulations, and a Critical Estimate of the Facts and Theories*

Temperaments and dispositions have their foundation in what psychologists of the last century used to call general feeling or *Gemeingefühl*. Such feelings arise, according to Ribot, from "a number of internal sensations of an exceedingly small intensity value. These inflow from the general working of the nervous system, from circulation and nutrition, in short, from all the functions the *ensemble* of which we describe as the manner of our existence."

The impulses and the peculiar *penchants* are in some way *en rapport* with the vast unconscious life which lies at the base of all conscious phenomena. These, however, have their setting in the entire system of organic functions. The latter, dependent as they are upon the organs of the body, can easily be conceived to be heritable in their nature. Hence, the patterns of *penchants*, disposi-

tions and temperaments which are in some manner connected with the bodily organs and functions, may also be conceived for this reason to be heritable in their nature (5).

The conclusions so formulated seem to be plausible. But the fact that they do not militate against reason and experience does not mean that the hypothesis of inheritance is verified. There are several serious objections against the acceptance of Ribot's theory and the theory of inheritance of dispositions.

(i) In the first place, the facts upon which the theory of inheritance rests are mainly in the nature of anecdotes. These, adduced as instances of dispositions, temperaments and impulses, are incapable of precise definition. For this reason a mental trait of one group of persons cannot be compared with that of another. This is more so inasmuch as an anecdote reflects more the subjective attitudes of the groups in which it circulates than an objectively definable reality. We do not know in the instances cited, how far a temperament or a proclivity attributed to members of a family is truly an exception. Its peculiarity may lie entirely in the imagination of the narrator of the anecdote. It is not possible, under these circumstances, to make any definite statement in regard to the inheritance of the trait in question.

(ii) Secondly, it is difficult, on account of such indefiniteness in the very nature of the data, to estimate the contributions of heredity and environment separately. It is, for instance, impossible to say how far the tendency to voracious eating grows through imitation and social influence or through heredity. Even if the influence of heredity is operative in such cases, it would be impossible to estimate the amount of such influence. The hypothesis of inheritance, therefore, is not verified in these cases.

(iii) Thirdly, the correlation between the traits in question and the physiological functions, as Ribot's theory suggests, is of a very general nature. One may concede that dispositions, temperaments and proclivities

are constituted of organic and kinaesthetic sensations. It may also be conceded that these sensations arise in the course of the working of certain organs of the body. But the acceptance of such a general proposition does not amount to the acceptance of the hypothesis of inheritance of particular dispositions and temperaments.

It is necessary to show, for this latter purpose, that (i) these sensations of small magnitude and the unconscious processes that constitute the dispositions, are correlated with the function of particular tissues. But from the very character postulated for these sensations, such a correlation cannot be established. (ii) Secondly, even if a connection of this nature could be established, it would have to be shown that individuals exhibiting particular kinds of temperament or disposition possess specified structural and functional peculiarities of the organs and tissues in question. This was *assumed and not proved* to exist in the schemes of early speculation. (iii) Thirdly, it must be shown, in order to prove the hypothesis of inheritance, that the functional peculiarities of tissues with which the constituents of temperaments and dispositions are connected, arise from the *innate structure* of the tissues, and not from the influence of the environment. For, heredity is 'organic resemblance based on descent.' The organs and tissues by virtue of their resemblance between parental and descendant stocks, are best understood as mediators of mental inheritance.

None of these points are proved in the early thought as summarised above. They are accepted implicitly or explicitly as beliefs that scientific thought seems to justify. But each of these is subject to scrutiny and doubt. The objections that are urged against the inheritance of temperament and disposition cannot be readily laid aside. The conclusion to which we are led is that the early thought has transmitted nothing more than plausible beliefs in regard to the question at issue.

§ 5. *Psycho-pathic Constitutional Types:*
Rosanoff and Kraepelin

Certain personality-types undoubtedly have their basis in the make-up and internal organisation of the body. (i) Rosanoff describes five main types of personality in terms of well-defined mental symptoms. The types are :

Normal personality possesses powers of inhibition, nervous stability and rational balance together with a high rating of intelligence. It appears in the matter of heredity as a dominant character in relation to the other types described below.

Cyclothymic personality exhibits in the childhood the following symptoms : readiness to cry and scream ; elation boisterousness and emotional instability ; talkativeness, unstable attention and restless activity ; playfulness, given to pranks, madcap adventures and youthful enthusiasm. All of these become more balanced with growth and maturity. Its constitutional basis is the same as that of manic-depressive psychoses.

Autistic personality shows itself in early life in the form of abnormal shyness, inability to take part in social conversation sometimes amounting to mutism, tendency to lapse into stereotyped movements, indulgence in day-dreams and susceptibility to delusions and hallucinations. All these symptoms, again, may be outgrown in childhood ; or, they might consummate into the *Dementia praecox* syndrome.

Anti-social personality exhibits itself through pathological lying, swindling and false accusations directed against innocent persons, and through hysteric symptoms, malingering and petty crimes. These, as in the previous cases, are often merely the phases of early life which are outgrown. In other cases they consolidate into a psycho-pathic personality.

The anti-social psychopath instances a general failure of development that leaves the personality on the juvenile

plane *minus* the plasticity and spontaneity of the child. The traits or impulses that make up the personality are said to show a kind of dominant-recessive relation more or less after the manner of Mendelian unit characters in heredity.

The epileptic personality expresses itself in the rapid flux of ideas and alternation of moods, in brief spells of irritability, in set prejudices that refuse to dissolve, and in the stress on the ego-feeling. At the same time there is meticulous attention to details, inconsistencies in behaviour, delirium-like states and even periods of unconsciousness. These may be outgrown in many cases; they consolidate into a disease-complex in some instances. Since epilepsy, as has been suggested in a previous chapter, has a hereditary basis, these symptoms too must be traced to a constitutional and therefore to a hereditary foundation.

The personality types of Rosanoff, then, are also constitutional types. The constitutional foundation exists even when there is no pathological consummation. In the latter case, however, as we have found in a previous chapter, there are grounds for believing in inheritance. The same principle should hold in the cases where the symptoms mark a passing phase. For, according to Rosanoff, there is no hard and fast distinction between the two sets of cases (6).

(ii) Other writers, notably Kraepelin, prefer a less elaborate scheme for the classification of personalities. There are, according to Kraepelin, two principal types of personality : (a) The personality with the constitutional psycho-pathic state and (b) the psycho-pathic personality. There is no hard and fast distinction between these types beyond the fact that they sum up two sets of traits. The former is attributed to morbid heredity while the latter represents a general trend of decline of the personality towards a degenerate level not specifically attributable to inheritance.

The *constitutional psycho-pathic states* are represented by perverted sexual impulses, impulsions towards kill-

ing, tormenting, setting fire, hoboism and stealing, and by the concepts of "nervousness", excitement, despondency and phobia. The *psychopathic personalities* are definable in terms of certain anti-social acts such as lying, swindling, false accusation and habitual criminality. The latter traits represent a failure of development of the powers of inhibition and co-ordination. So far as the individual is conceived as an integral whole, the personality in these cases remains on the childhood plane. Yet, the specific tendencies such as sex, appropriation, and ego-impulses of assertion and submission may appear in their adolescent character. The psycho-pathic personality, thus, is an adult so far as single traits are concerned; it is a child so far as co-ordination and balance are considered.

These latter factors may fail to develop for various reasons. The failure of development may be due to a trauma of child-life, to social conditions or to the exaggeration of one of the impulses. But any of these factors may operate on a hereditary base of personality. The psycho-pathic personality, for this reason, cannot be wholly attributed to inheritance (7).

§ 6. *Personality-types: Jung and Jaensch*

It has been suggested, on the basis of clinical studies, that men and women can be classified into fairly well-defined personality-types, each of which exhibits its own profile of mental states and behaviour. These types are often believed to be grounded in man's biological nature and are, therefore, capable of hereditary transmission. The personality-types, in other words, are fundamental *bio-types*.

Jung classifies personalities into two large types, the *introvert* and the *extrovert* (8). To the former belong individuals who tend to withdraw from social intercourse as much as their avocations in life will permit. To the latter belong persons who enjoy social life and are more interested in a life of action and in the events

of the external world than are the introverts. The introverts are reserved in their emotional life while the extroverts are expansive and demonstrative. The introvert minds, when they give way, manifest signs of neurasthenia. The extrovert minds, on the other hand, are more likely to suffer from hysteria and dissociation. The normal personality types, in this way, have their particular modes of disintegration. A number of traits, behavioural and psychological, normal and abnormal, serves to define the hereditary foundation.

The pathological traits of personality, however, often run in families. We have seen in a previous chapter that there is a hereditary basis for such family-wise distribution. It is plausible to hold, therefore, that the personality-type, with which the abnormal state has a close linkage, has also a hereditary foundation.

Jaensch approaches the problem of personality and temperament, and of types through the avenue of an apparently superficial trait, the eidetic image. The eidetic image refers to an external object in space and is characterised by heightened vividness. In certain cases the individual can call up and alter the course of the imagery with an effort of will. In other cases the imagery arises spontaneously and pursues its course in spite of efforts to control or alter its profile. Susceptibility to one or the other of these kinds of eidetic imagery is found to be associated with different kinds of mental and behavioural changes.

The first of these types is called by Jaensch the B-type; and the second one the T-type. The B-type manifests a rich and variegated emotional temperament and often a high degree of impulsiveness in behaviour. The T-type is associated with a certain general irritability, excessive activity and inability to relax from the condition of tension in which the individual normally lives. As a matter of fact, the types receive their name from certain pathological symptoms. The letter B stands for the Basedow syndrome. It consists in a prominence of eye-balls, rapid action of the heart, tremors and wide-

spread mental disturbances. The letter T stands for the condition of tetany which involves spasm and tremor of muscles as also unco-ordinated muscular movements when an effort is made to execute a voluntary movement. It is suggested that the B-type and the T-type exhibit certain symptoms that resemble the Basedow syndrome and the condition of tetany respectively.

The clear-cut distinction between the types, however, is said to disappear in the course of growth. One overlaps the other. The types may thus be said to be patterns of growth. The organism as it grows up exhibits its mental functions and adaptive behaviour in a variety of *patterns*. Each of these *patterns* represents a personality-type which then marks a *phase* in the process of growth. And each *phase* yields place to another as long as the process of growth continues.

These passing personality-types are not ephemeral as they seem to be. They are traced back to certain primal and relatively more durable factors in the make-up of the individual, to the deeper trends of the personality. The B-type and the T-type associated with eidetic imagery, likewise, have their roots in the more durable constituents of the personality, physical and mental. For, the susceptibility to eidetic imagery is said to depend upon the constitutionally determined and, therefore, upon the relatively more permanent factors (9). It is easier to conceive of these in terms of inheritance. The personality and temperament types can, then, be better understood as hereditary characters.

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CHAPTER XIII

PERSONALITY-TYPES AND TEMPERAMENTS.

§ 1. *Physical Basis of Psychological Types:* *Earlier Speculations*

The doctrine of personality-types and temperament-types considered in the preceding chapter is strengthened by parallel theories of body-types and of a correlation between physique and character. But the physical traits, such as the general build of the body and of the particular organs, are heritable. The mental characters with which these traits appear to be most often associated should, then, also be regarded as heritable. Inheritance of specified kinds of physical traits is an argument in support of heredity of the correlated mental traits.

Attempts have been made from very early days to divide mankind into a few well-defined anatomical types found among almost all the racial groups. These are regarded as *bio-types*, types of the human body which are the basic or primary products of evolution. Other forms of the body arise through a genetic blend of these.

Hippocrates and Galen attempted to classify human bodies and personalities mainly from the angle of medical diagnosis. The former subsumed human bodies under two concepts, *habitus apoplecticus* and *habitus phthisicus*. These constitutions, however, implicate certain kinds of temperament. Since the body-types are heritable, the temperaments, too, would have a heritable basis. Galen was the propounder of the well-known classification of temperaments into the sanguine, choleric, phlegmatic and the melancholic. He suggested that these had their basis in the relative predominance of one or the other of the "humors" or fluids that circulate in the body.

The middle of the 19th century was a period fruitful for speculations of this kind. Walker, the anthropologist, classified the body types in 1852 under three categories, *Nutritive Beauty* (Venus), *Locomotive Beauty* (Diana) and *Mental Beauty* (Minerva). These roughly correspond to (i) bodies that are round in the middle, (ii) those in which muscles and bones are more developed, (iii) and those that strike a balance between these two.

As a matter of fact, this mode of classification has been followed for a long time by a large number of investigators. The variety of terminology signifies virtually the same profiles of the body, each worker stressing one or the other anatomical unit. The following table has been made out of a larger table presented by Cabot (1).

TABLE I.

Worker.	Type 1	Type 2	Type 3	Type 4
Halle (1797)	Thoracic	Abdominal	Muscular	Nervous and cephalic type
Troisvèvre (1821)	"	"	—	Type Cranien
Rostan (1828)	Respiratory	Digestive	Muscular	Cerebral
Walker (1852)	—	Nutritive Beauty	Locomotive Beauty	Mental Beauty
Carns (1853)	Asthenic	Phlegmatic	Athletic	Cerebral
Beneke (1878)	Hypoplastic	Hyperplastic	Normal	

Each of these body-types implicates a particular order of temperament. Laziness and activity, phlegmatic and excitable dispositions, together with the pattern of impulses and desires that go with each, define the temperament and the type of personality. Since, however, the

body-types are heritable, the temperaments that are associated with them must also be regarded as hereditary.

§ 2. *Later Studies*

Later studies carried on from the beginning of the 20th century seem to adhere to the same kind of classification of the body-types as described above. The following table, formulated on the same basis as Table No. 1, represents the situation.

TABLE II.

Worker.	Type 1.	Type 2.	Type 3.
Manouvrier (1902)	Macro-skeletal	Brachy-skeletal	Meso-skeletal
Sigaud (1908)	Respiratory	Digestive	Muscular
Mills (1917)	Asthenic	Hyperasthenic	Sthenic
Brugsch (1918)	Narrow chested	Wide chested	Normal chested
Viola (1919)	Micro-splanchnic	Macro-splanchnic or Megalo-splanchnic	Normo-splanchnic
Davenport (1923)	Slender bio-type	Fleshy	Medium
Kretschmer (1925)	Leptosomic or Asthenic	Pyknic	Athletic

The special features of the later studies consist in the attempt to associate, on the basis of case-studies, these body-types with specified orders of temperaments, and with tendencies to develop certain forms of mental diseases. Several surveys have been carried on in the psycho-neurological clinics, as at Moscow under Gurewtsch, and at Marburg under Kretschmer. Attempts have been made on the basis of such data to correlate

body-types with well-defined mental disorders. Willemse in South Africa has attempted to correlate body-types with types of delinquency on the basis of his studies of delinquents (2). Since both mental diseases and delinquencies have their roots in characteristic temperaments, it is suggested that temperaments are the direct associates of body-types. Since the latter are certainly inherited, it is further concluded that temperaments and dispositions too are hereditary factors.

The body-type, its temperaments and dispositions and its susceptibility to disease make up the total psychophysical constitution. It is the foundation of the personality. It indicates the extent to which the human organism is likely to maintain its integrity in its dealings with environment, physical and social. It also determines the manner in which particular kinds of psychophysical constitution would respond to environment. The body-type, then, is only the visible somatic structure. Empirical observations in regard to the mental correlations of the body-type bring to light the functions and susceptibilities which further serve to define the constitutional-type.

§ 3. *The Body-type and the Constitutional-type*

Determination of the body-type depends upon certain precise measurements. Naccarati, for instance, proposes the following formula (3):

$$\text{Morphological Index as a single measure of the body-type} = \frac{\text{Length of one arm} + \text{Length of one leg.}}{\text{Volume of the trunk.}}$$

Another measure, said to be more indicative of Kretschmer's types, given by Wertheimer and Hasketh, is as follows :

$$\frac{\text{Leg length} \times 10^3}{\text{Transverse chest diam.} \times \text{Sagittal chest diam.} \times \text{Trunk height.}}$$

A third formula known as KAB index, after the names of the authors Klineberg, Asch and Block, is simpler than both of these (4):

$$\frac{(\text{Standing height})^2}{\text{Sitting height} \times \text{Weight}}$$

Sitting height \times Weight

These measurements serve to single out the three types of constitution defined by Kretschmer. The first is the *Leptosome* or *Asthenic* type that possesses long limbs and narrow body-cavities. The second is the *Pyknic* type possessing small limbs and large body-cavities. The third is the *Athletic* type representing a well proportioned body.

It is pertinent to the issues brought out in the preceding sections to raise the question of mechanism of inheritance of dispositions and temperaments which are associated with the body-types. The *constitution* is determined by the interactions and interlacings of the *genotypal* and *paratypal* factors. The former are relatively fixed in character and form at the time of fertilization of the genetic cell. The paratypal factors change with the stresses of the environment. The persistent disposition or the *Anlage* which determines the direction of the impulses and the quality of the temperament, it is suggested, corresponds to the genotypal factor. Thus, an organic basis is posited for the heritable aspects of the body-type and its mental correlates (5).

A large mass of data, derived from clinical observation, experimental work and tests, has a bearing on the problem of constitutional-type. There are also several theories of personality-type that parallel the concept of constitutional-type. All of these implicate the notion of mental inheritance.

§ 4. *Personality-types and Psychological Responses*

The types of Kretschmer's schema have been subjected to experiments with a view to determining

the character of their sensori-motor and perceptual processes.

(i) Münz and Enke applied the *Rorschach tests* to persons of different constitutional-types (6). These tests comprise a series of ten specially prepared symmetrical figures. Some of these are black and some white ; some represent a pattern of white and colour ; and some are painted entirely in colours. The subjects are required to report the aspect of the figures that they see. The colour and the form, the movements that are seen in the figures, and the number of movements, as also the degree of clearness of the form, are the aspects that are brought out in the course of the test.

According to Rorschach, the tests bring out the normal tendencies to introversion and extroversion. Each of these can be divided into two types, active and passive. These two broad tendencies are found from early childhood. Training and the constitution of the child determine which of these would gain the upper hand. The typical forms of response in these tests are the reports of movement-perception, colour-perception and form-perception. The ratio between the number of these reports determines the relative dominance of the introversion and extroversion tendencies. According to Rorschach, such dominance indicates the amount and the direction of training that the individual has undergone (7).

Shuey suggests that these tests indicate "the degree of integration of the perceptual processes and not the kind of training, as Rorschach assumes." According to Shuey, the primary kind of thing-adjustment is a total colour-form-movement orientation. This differentiates into responses to parts of things, into forms, colours and movements. The final stage of differentiation occurs with the separation of images and perceptions. The Rorschach tests, it is suggested, exhibit the degrees of integration and differentiation (8).

The following table sums up the studies of Enke, Münz and Scholl :

TABLE III.

Type.	Responses.
Leptosome	Kinaesthetic reports given less emotionally. The whole figure.
Pyknic	Fewer kinaesthetic answers. More emotional. Details of figures.
Cyclothyme	Sensitive to colour.
Schizothyme	Sensitive to form.

(ii) A considerable amount of work has been done in regard to the different aspects of motor life of the personality-types. The result of one group of workers, mainly German and Russian, is summarised in the following table :

TABLE IV.

Types.	Characteristics.	Remarks.
Schizothyme	Strong perseverator.	These traits found among children of 10-12.
Cyclothyme	Weak in perseveration.	
Leptosome	Perseverative, more theoretical, stereotyped, analytic, suppressed personality.	
Pyknic	Objective, changeable, emotionally naïve.	
Athletic.	Quiet, slow, staid in the method of expression, minimal sensitivity to stimuli, not imaginative or creative, general sluggishness.	

The correlation between the physical types and differential psychic functions, as revealed by these data, is not supported by experiments carried on by other workers. Klineberg, Asch and Block, the authors of the KAB formula referred to above, come to several important conclusions on the basis of their studies : (i) The coefficient of correlation between the data of tests applied to more than 300 persons is so low that there is no evidence of a general factor implicated in them. (ii) There are, again, no significant differences in the scores of the tests employed, corresponding to the difference between the physical types, leptosome and pyknic, among the male subjects. (iii) Among the female subjects, correlations were low and unreliable. They even indicated at times a tendency opposite to what might be expected according to the typological theory. (iv) The studies thus furnish negative conclusions in regard to the existence of the two personality-types in their psychological aspects in the normal population with respect to the group examined by them, a group of 153 male and 175 female college students.

The reliability of the investigations that attempt to establish clear-cut personality-types has been impeached on the following grounds :

- (i) It has not been possible to ensure the homogeneity of the groups studied with respect to age, sex, intelligence, social and economic conditions and educational antecedents in the typological researches. The mental test scores do not possess much significance under the conditions of heterogeneity in these respects.
- (ii) The reliability of the tests employed is unknown. They have not been adequately standardised.
- (iii) The measures of dispersion are not given.

The general conclusion is that typology to-day does not possess any significance with respect to the ordinary psycho-physical functions among the normal bio-types (9).

§ 5. *Constitutional-type, Temperament, Mental Disorder and Delinquency*

The idea that the body-types implicate the more fundamental functions more than the simpler psycho-physical processes, leads us to the hypothesis that they have their specific correlations with temperaments. The temperament predisposes the personality to certain kinds of mental disorder. A correlation is thus suggested between the constitutional-types and mental disorders. The body-type determines the pathological transformations of the individual, physically and mentally (10).

Kretschmer conceives of two broad types of temperaments. These are schizoid and cycloid.

The schizoid characters, arranged according to their statistical frequency, are :

- (i) Unsociable, quiet, reserved, serious (humorless), eccentric.
- (ii) Timid, shy, with fine feelings, sensitive, nervous, excitable, fond of nature and books.
- (iii) Pliable, kindly, honest, indifferent, dull-witted, silent.

The cycloid characters are :

- (i) Sociable, good-natured, friendly, genial.
- (ii) Cheerful, humorous, jolly, hasty.
- (iii) Quiet, calm, easily depressed, soft-hearted.

The normal individuals possessing schizoid and cycloid characters are called *schizothymes* and *cyclothymes*. Kretschmer sums up the character of their constitutional build in the following table (11).

TABLE V.

Features of the Constitution.	Cyclothymes.	Schizothymes.
Psychaesthesia and mood.	Diathetic proportion between gay and sad.	Psychaesthetic proportion between sensitive and cold.
Psychic tempo.	<i>Wavy</i> temperamental curve: between mobile and comfortable.	<i>Jerky</i> temperamental curve: between unstable and tenacious. Alternation in thoughts and feelings.
Psycho-motility	Adequate to stimulus, rounded, natural.	Often inadequate to stimulus, restrained, lamed, inhibited, stiff.
Physical affinities.	Pyknic	Leptosome, Athletic, dysplastic and their mixtures.

Body-types, temperaments and activity-profiles are, thus, found, according to Kretschmer, in close correlation. A similar table sums up the correspondence between the body-types, temperaments and susceptibility to mental diseases (12):

TABLE VI.

Body-types.	Temperaments.	Special trends.	Affinity to diseases.
Pyknic	Cyclothyme	Hypomanic Syntonic Heavy blooded.	Alternating Psychosis (manic-depressive).
Leptosome	Schizothyme	Hyper-aesthetic, middle position, anaesthetic.	Schizo-canic nuclear group of schizop- hrenia.
Athletic	Viscous temperament.	Phlegmatic, Explosive.	Katatonic type of Schizophre- nia. Epilepsy.

If body-types implicate certain kinds of temperaments, the latter in their turn implicate certain orders of delinquency. Studies along these lines have been carried on by Willemse. The following table illustrates the type of correlation intended here (13) :

TABLE VII.

Type.	Temperament.	Delinquencies.
Leptosome	Schizoid	Calculated, Scheming, Premeditated crimes.
Athletic	Schizoid	Tenacious energy, Paranoia, bravado in deeds.
Athletic	Epileptic syndrome, "Driven-bound Polarity".	"Driven" crises lead to acts of violence. Disregard of social opinion due to self-regard. Lack of fear and scruples. Calculativeness. Alcohol and sex.
Pyknic	Cycloid, choleric	Momentary aggressions and crimes, sexual excesses. Gang leaders. Juvenile crimes.

§ 6. *Personality-types and Normal Adjustments*

Kretschmer's psychological classification is true, it is urged, in regard to the total pattern of the personality. The configurations that the psycho-physical functions build up may not possess correspondence in any marked degree with the relatively isolated and superficial psycho-physical functions considered in the preceding section. The simple tasks of perception, memory, discrimination or motor-skill may not reveal the constitution, nor may they be diagnostic of the deeper trends of the types. It is therefore suggested that the emotional qualities, suc-

cesses or failures in social and other types of more enduring adjustments, extroversion and introversion, domination and submission, should be better indications of the personality as a whole. The negative result reported in the preceding section is due to a bad selection of topics for the tests.

Approaches to the problem, with the adjustment of the entire personality as the standard, lead to the discovery of several points of difference between the types. Pillsbury, in his study of college students, finds that more individuals of the pyknic type than of other types leave college without completing the course. Others find that stutterers are more frequently to be found among the leptosome and lepto-athletic groups.

A number of investigators in Russia have touched upon certain basic abilities and emotional trends. The cyclothymes, according to these studies, exhibited a marked alternation between excitement and depression as their manic-depressive make-up would suggest. But they were also found to be affable, altruistic, good-humored, realistic and easily excited. They had a tendency to dominate others in their more expansive moods. At the same time, they were haunted by a tendency to indecision in action. The schizothymes, on the other hand, were characterised by a lack of humor, a tendency to confine themselves to a narrow circle of friends, inhibition of emotions, egoism and phantasy-building. All of these contributed to an absence of directness in behaviour and mental outlook.

Other lines of work bring out the fact that children who give schizothymic reactions have a body-build of the astheno-athletic type. They are musical and excel in literature. Those who give cyclothymic reactions have a pykno-athletic body-type. They possess marked abilities in drawing, technical skill and a sense of motor-rhythm. The types of physique are thus found to be correlated with emotional, social, and scholastic propensities; and these represent deep-seated trends of the personality (14).

§ 7. *Pedigree of Personality-types*

Kretschmer gives the psychological pedigree of several patients in order to exhibit the familial medium in which pathological conditions corresponding to these personality-types grow. Since the body-type is inherited, the family "characterology" is expected to correspond to the family physique. The general trend of behaviour and the tenor of attitudes and dispositions are the characters that form the basis of pedigree in this context. It is obvious that these factors cannot be readily subjected to quantitative evaluation when several generations of a family are concerned. For, it is safe to presume, in the present state of psychological technic, that the same scale of observation has not been applied to all. The scales for the estimation of attitudes, dispositions and temperaments are of recent date and have not yet had a sufficiently wide appeal in the forum of psychology. Secondly, even when all the members of a family are living, it is difficult to have a single scale applicable to all the age-groups. The pedigree of characters, therefore, indicate merely a group of psycho-physical tendencies qualitatively considered. The data presented must have been gathered from verbal reports which so easily conceal gossip and personal evaluations under the guise of statements of facts.

TABLE VIII.

Types of Schizophrenic Family :

Parental Group :

1. Father's sister—unsociable, extraordinarily excitable.
 2. Father—Paranoic, eccentric, subject to anxiety, misanthropic, depressed.
 3. Mother—A short period of persecution mania, alcoholism, humorless, pedantic, depressed.
 4. Mother's sister—avaricious.
 5. Mother's brother—alcoholism, vagrant.
-

TABLE VIII.—*Contd.*

Children Group :

1. Patient—Schizophrenia, persecution mania with katatonic attacks; quiet, eccentric, conscientious, depressed ; a deep feeling of inferiority.
 2. Brother—Inventor, stormy puberty, passionate, depressed, restless.
 3. Brother—generally like the patient—shy with other people, good at his business, conscientious.
 4. Brother—quiet, serious, logically minded, unsociable.
-

Such families, according to Kretschmer, supply a perfect breeding ground for the schizothymic characters. The brothers 3 and 4 are socially healthy ; but the maternal side is heavily loaded with psychotic characters.

TABLE IX.

*Type of Circular Family with prevailing bright
temperament*

Parental Group :

1. Father—peaceful, contented, industrious, conciliatory, fond of music, grower of fruit plants.
2. Mother—bright, friendly, musical, talkative, social.
3. Mother's sister—bright, humorous.
4. Mother's sister—similar to 3.

Fraternal Group :

1. Patient—Manic-depressive, good-natured, bright, contented, humorous, industrious.
 2. Brother—professor of music.
 - 3, 4, 5. Sisters—Lively, sociable, kind-hearted.
-

This family group, according to Kretschmer, supplies a suitable background for the hypomanic temperament.

TABLE X.
Confluence of Inherited Traits

Parental Group :

1. Father's two brothers—friendly and sociable.
2. Father—Epilepsy, whimsical, inventive, passionate, strict, unsociable, shy.
3. Mother—Soft emotions, friendly and sociable, remembered affectionately by many.

Fraternal Group :

1. Patient—manic-depressive, too soft emotions, kind-hearted, friendly, religious, quick anger.
 2. Brother—tendency to depression but under control ; gay, humorous, sociable, energetic, decided, firm, passionate, a leading manufacturer.
 3. Sister — soft-hearted, friendly, somewhat affected, religious sentimentality, gentle but energetic.
-

The mode of inheritance in this case is explained by Kretschmer in the following manner : "Either that the father (his two brothers are friendly and sociable) supplied an hereditary element of a circular nature, which was not manifested in a clearly recognisable form in himself, to the maternal generative basis which pointed in the same direction", or "the specific circular basis comes from the mother, and only its degenerative deterioration which reached far enough to allow of a circular psychosis, comes from the father" (15).

Kretschmer discourages the other alternative of *polymorphism* of inheritance as an interpretation. But whichever of these alternatives is taken, inheritance computed in terms of the traits revealed in the genealogical table, remains a highly speculative hypothesis. There is but little specificity in the traits described. The interpretation of the pathological consummation in terms of these appears to be in the nature of a back calculation of the result already known. The view that inheritance is the only causative factor, is tacitly accepted.

§ 8. *The Mechanism of Inheritance*

The foregoing discussion shows that Kretschmer proposes inheritance somewhat in the manner of the Mendelian formula. The traits that remain recessive in the parental group may become dominant in the children's group and *vice versa*. There are two possible ways of conceiving the mechanism of inheritance in this fashion. One theory may be formulated essentially in terms of the body. A second may be formulated in terms of the mind-body complex, the basis of which we have defined in a previous chapter as '*constitution*'.

(i) The argument in support of the first of these views rests on a theory of two-fold correspondence of temperaments with the endocrine glands and of the latter with the body-types. It is found that disturbances in the functions of endocrine glands lead to profound alterations of temperament and personality. It is also found that these glands are capable of wide variations in size and weight from their averages. It is further to be supposed that these variations in size and weight correspond to variations in functions. In this manner, it is possible to place a series of physical variations of a wide range, parallel to variations of temperaments and personality. Since the variations in the size, weight and function of the glands can be traced to physical inheritance, it is suggested that the inheritance of the personality-type is mainly a reflection of the inheritance of the body-type. Heredity of mental traits is a correlate of heredity of specified physical traits (16).

It is, however, not easy to subscribe to this hypothesis which is yet to be verified in its details. The outline of the theory is simple and plausible. It may even be conceded on general grounds. But it has yet to be shown that the variations of the temperament T parallel the variations of the glandular functions G in the observed cases. Such proof is difficult to adduce.

(ii) "Neither the physique nor the psychosis," says Kretschmer, "are themselves the constitution in the

strictest sense of the word. The constitution is the inherited foundation. Both these two, just as the personality, are only part of the manifest expression of the total inherited mass." The carrier of heredity, then, is neither the body, nor the mind, but something else.

The unit is in fact according to this view a body-type-temperament-type unit. "On the ground of our investigations," says Kretschmer, "we may suppose that the circular (Manic-depressive) psyche and the pyknic physique have nearly related, and perhaps in essentials, identical germinal foundations, and similarly with the schizophrenic psyche and the asthenic (Lepto, athletic, etc.,) physiques. Supposing that an individual has inherited a certain germ plasm from his parents, half of which involves a tendency to a pyknic-circular nature, and the other half the tendency to asthenic-schizophrenic nature. Now the pyknic-circular foundation, or the asthenic-schizophrenic foundation can predominate as well in the physique as in the psychic character (and in the psychosis). In this case, the external form shows the usual psycho-physiological combination. Or, the external appearance may betray an even alloy, in which case you would have a mixed pyknic-asthenic foundation as regards the body, hand in hand with a circular-schizophrenic mixture on the psychic side."

Some of the elements of these compounds according to this conception may be *dominant* and the others *recessive*. For instance, of the compounds considered above, asthenic-circular traits may become dominant while the pyknic-schizophrenic factors may remain as recessive components of the personality. In this way, the mental and the physical traits would manifest themselves according to the Mendelian laws of inheritance (17).

It is clear from the above exposition that the carrier of inheritance must ultimately be conceived as a physical entity, the germ-plasm. Unless a psyche is attributed to it, the mental traits must be conceived as correlates of the physique and the organs of the body. The theory of inheritance of the physical and mental personality,

then, would depend on the definiteness of data in regard to certain points :

- (i) Firstly, the physical types must be unambiguously established without overlapping.
- (ii) Mental types, too, must be established in the same way.
- (iii) A relationship must be established unequivocally between the two sets of facts.

§ 9. *A Critique of the Theory of Constitutional-type and its Inheritance*

The following table gives some of the physical measurements as cited by Kretschmer :

TABLE XI.

Types.	Height.	Weight.	Shoulders.	Chest.
Asthenic or Lepto	168.4 C. M.	50.5 (kilo)	35.5	84.1
Athletic	170	62.9	39.1	91.7
Pyknic	167.8	68	36.9	94.5

(i) A sufficiently large number of individuals tested with respect to these items would not form easily definable groups. The measurements would give a normal frequency curve rather than a poly-modal curve. Unless we have a clearly poly-modal distribution, we cannot define the physical types without overlapping.

(ii) The same difficulty arises also in the case of mental traits. Whenever we have a dichotomous division, or even a division into several mental types, there is a suggestion for the introduction of the concept of mixed types to cover the cases that fall outside the 'types' and make them overlapping. Jung suggests an *ambivert* type to cover the cases of individuals who are not predominantly introvert or extrovert. If the cases are taken

in sufficient number from the general population of a certain class, such as school children, and the units are not specially selected, a normal frequency curve will be obtained in most of the cases. An arbitrary selection of cases would give a poly-modal curve almost with respect to any trait that may be tested (18).

(iii) Thirdly, the correlation between the morphological indices and certain fundamental personality-traits, has been found in many cases to be too low to yield any positive conclusion. The following table illustrates the point (19):

TABLE XII.

D	Traits tested.	Correlation.	
4	Emotional excitability	..	..
	Aggressiveness	..	..
	Leadership	..	..
	Sociability	..	..
	Perseverance	..	..
		.00	-.08
		-.14	-.22
		.01	

(iv) Fourthly, the types exhibit their true psychophysical profiles in different epochs of life. It is said that leptosomes can be readily recognised in childhood whereas the pyknics can only be recognised as such by the eighteenth year. It is admitted, however, that this type is not fully recognised until the age of 30-40; and the athletic type does not emerge until after pubescence. The purely hereditary character of types is thrown into question in view of such diversity in the time of emergence. The rôle of training and environment and their stress on the system cannot be adequately evaluated and eliminated (20).

These facts indicate that the concept of constitutional-type as envisaged in the typological studies is not sufficiently established to be applicable to the general or unselected population. It may hold true in extreme cases exhibiting a certain combination of physical and mental traits; and the latter may be of pathological or otherwise of an unusual character. The type of inheritance

as proposed by Kretschmer may be possible in these instances.

The theory of inheritance as based upon the type-theory, for all traits and all people, is not proved. We may postulate inheritance, then, for rare and pathological traits. The general proposition that all mental traits are heritable and that the pattern of mind is determined by heredity, is not established.

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- (17) Kretschmer—*op. cit.*—p. 94-95.
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- (20) Cabot—*op. cit.*—p. 20.

CHAPTER XIV

THEORETIC APPROACHES.

§ 1. *Introduction*

The belief that mental traits are inherited is widely prevalent among the primitive and the cultural races alike. Among the primitive races, it is often believed that ancestors are reborn as their own progeny. Such beliefs, often deeply ingrained, explain the perception of resemblance between successive generations. Among the cultural races it is sometimes held as a faith that a dominant personality, strong in its goodness or wickedness, projects itself through some media, spiritual or physical, into the later generations. The personalities in a family are thus stamped with the likeness of the forbears.

The belief in mental inheritance has certain practical consequences. Heroes and cowards, the pious and the wicked, have their own lines of descent. Trust and responsibility are the due of some, not of all. Such is the plea of those who support a scheme of aristocracy, racial, social and intellectual. It is necessary to give such beliefs a basis in fact. And the best foundation is the concept of mental inheritance.

But such a theory of inheritance would throw on the parents the blame for all the perversities that the child exhibits in the course of growth. And yet the traits of children have but a remote correspondence with the known character of parents and of ancestors. A general explanation in terms of racial and biological factors is needed.

Such an explanation is given by two early theories of mental inheritance, the theory of Recapitulation and the

Culture Epoch theory. The former rests on the fact that the human embryo passes through all the main stages of evolution that the species has passed through. On this biological fact rests a psychological theory of great generality. It is suggested that as the child grows up it *recapitulates* or repeats in an abbreviated form all the stages of mental life and behaviour through which the human race has passed. It thus inherits the modes of behaviour and of subjective life of ancestors of man who lived thousands of years ago.

Now, it is manifest that the correspondence implied in the theory is said to exist between events that occur in two different periods of time and in two different stages of existence. The physical process of recapitulation is intra-uterine. The suggested phenomenon of recapitulation is in the stage of extra-uterine existence. The theory is, thus, a poetic analogy and nothing more.

The Culture Epoch theory is parallel to the theory of Recapitulation. It is formulated on the basis of anthropological data. The growing child, the theory supposes, exhibits the same profiles of interests and activities as the race manifests in the course of its cultural evolution. The stages of racial culture are thus paralleled by the genetic history of the individual. The theory was put forward principally as a cue to the principle of co-ordinating the various subjects of instruction. The materials of instruction, to suit the stages of mental development of the child, should be selected and arranged according to the stages of the cultural history which the child exhibits in the course of its growth.

But the theory has also a significant implication for the hypothesis of inheritance. The individuals of a race, it is suggested, pass through the long forgotten phases of racial history, abbreviated to fit in with the brief span of a personal life. They also exhibit the profiles of interest in the order in which the race manifested them. Cultural life, however, always conceals the history and the past tendencies. The reappearance of these in the child, yet untutored in the racial tradition, can more

plausibly be explained in terms of the hypothesis of inheritance. This hypothesis, like the other one considered in this section, is the result of a beautiful speculation. The correspondence between the stage of nomadism in the racial history and the child's interest in travels and adventures, is a distant one. So also are the other parallelisms upon which the theory depends (1). It rests upon analogy which is often too broad to be precise and significant for the purpose of scientific explanation.

• § 2. *Hering and Butler*

Many attempts have been made to resolve mental functions into a generalised form of the biological process. The idea that the different types of mental processes may be viewed as modes of biological adaptation has played an important part in the history of psychological thought. Darwin's analysis of expressions of emotion is a brilliant application of this idea. The analyses of the psycho-analytic school are also grounded in the belief that every mental function is essentially a mode of adaptation.

There have been other views of late, more general in their significance, which have attempted to resolve mental processes into the constitution and functions of living matter. So long as there is a material continuity between one living body and another, there will be, of necessity, a trail of resemblances from one generation to another. The germ plasm that conveys the seeds of personality is the material bridge that maintains the continuity of inheritance. But it does not necessarily explain the inheritance of mental life; for, mental states are *functions* which *arise in response* to the stimuli that environment showers upon the organism. Unless there is some method by which these mental responses can be registered, the theory of mental inheritance becomes difficult to comprehend.

It would of course be possible to say that the whole

course of growth is implicit in the germ plasm. The adaptive responses that each stage of growth demands, are thus the associates of the organic structure and its changes. Mental functions as adaptive responses are in this manner implicated in the course of structural changes that we call growth. No mechanism other than that of physical inheritance need then be presupposed.

But the range of variability of these responses is wider than that of structural changes. It is thus impossible to associate the variations in mental responses with structural factors. One may say of course that there are certain organs, such as the endocrine glands, that vary within fairly wide limits. The functions of the mental personality correspond to these. Such an hypothesis would need a certain type of *reduction* of mental processes to a given base. For instance, the glands and their hormones are usually regarded as correlates of emotion-instinct processes. It would thus be necessary to reduce all mental processes, intelligence and thought, perception and imagination, attention and discrimination, to the common base of emotion-instinct. Such a reduction is possible on the basis of a particular kind of psychological theory. But the hypothesis of mental inheritance rests on too wide a range of facts to be wedded just now to one particular school of thought.

Hering, in his well-known essay on "Memory as a universal function of organised matter," begins with the idea that "the nerve substance preserves faithfully the memory of habitual actions." But the numerous filiations of the nervous system connect it with all the organs of the body. The germ-cells "that are marked out for independent existence cause a powerful reaction, even from the very beginning of that existence, on both the conscious and the unconscious life of the organism. We may see this from the fact that the organ of reproduction stands in closer and more intimate relation to the remaining parts and especially to the nervous system, than do other organs; and inversely, that both the perceived and the unperceived events affecting the whole organism find

a more marked response in the reproductive system than elsewhere."

Such an interrelation supplies a material basis for connecting "the peculiarities of an organism and the proclivity on the part of the germ in virtue of which it develops the special characteristics of its parent." The same hypothesis will explain how the individuals of a given species inherit the structural and behavioural patterns from the ancestral group. For, the organic life is more deeply impressed by the factors "that were congenital to the parent and which have happened through countless generations to the organised matter of which the germ to-day is a fragment."

The general conclusion drawn from this line of argument, summed up by Hering, is as follows: "An organised being, therefore, stands before us as a product of the unconscious memory of organised matter, which ever increasing and ever dividing itself, ever assimilating new matter and returning it in changed shape to the inorganic world, ever receiving some new thing into its memory, and transmitting its acquisitions by way of reproduction, grows continually richer and richer the longer it lives."

Hering uses the term "unconscious memory" as a process of perpetuation of a condition of matter, usually described in those days as vibration. Hence, inheritance ultimately implies a fact of physics, namely, a continuation of a state of activation of the material substratum. This idea was well-known in the last quarter of the 18th century in the writings of Bonnet, according to whom the fibres of the nervous system undergo a durable modification which constitutes the physics of memory and recollection. "It is to the shock of certain fibres that such sensation has been originally associated. Its reproduction or recall by imagination will still be related to the shock of the same fibres." (2)

Samuel Butler adds a psychological connotation to the concepts both of memory and heredity. Both of these, inasmuch as they are the determinants of personal identity, rest on a physical basis. This consists in

"the uninterruptedness of a number of vibrations" communicated from molecule to molecule of living matter. But there is an equation between vibrations, memory and heredity. Memory and heredity may, on this ground, be regarded as correlates of the same physical fact. The term 'memory', however, has acquired a new connotation. It is no longer a mere biological or a physical continuity but a *psychic occurrence*. The phenomena of development, according to Hering, correspond to the abeyance and recurrence of memory (3). "Life is that property of matter whereby it can remember—matter *which can remember is living*" (4). Heredity rests, then, on a two-fold foundation: It rests on a physical factor, the persistence of a particular type of molecular change in the living matter; it rests upon a psychic continuity that memory supplies.

Memory in this sense is an *acquired* experience and not an inborn trait such as instinct. Memory *is* heredity in the sense that "instinct and growth are due to a rapid unconscious memory of past experiences and developments in the persons of the ancestors of the living form in which they appear." Butler must, then, necessarily subscribe to some form of the Lamarckian theory in order to reconcile physics, biology and psychology in a single strand of a theory of inheritance. He says: "I may predict with some certainty that before long we shall find the original Darwinism of Dr. Erasmus Darwin (with an infusion of Professor Hering into the bargain) generally accepted instead of the Neo-Darwinism of to-day, and that the variations whose accumulation results in species will be recognised as due to wants and endeavours of living forms in which they appear instead of being ascribed to chance." (5)

Inheritance, then, is primarily a physical process. Its phases and profiles are revealed in the biologic processes of growth, arrest and decline, and in the mental and behaviour patterns. The mechanism that transmits the physical condition is 'unconscious memory', a physical-biological-psychological function.

§ 3. *The Mnemic Theory*

There is a resemblance between habit and memory inasmuch as both depend upon the repetition of a process. Such repetition is believed to effect a change in the physical system of the organism. The modification may be conceived as physical or chemical in character ; it may also be thought of as belonging to a hypothetical '*neutral*' category and mediating the physico-chemical, biological and psychological processes. In any case, memory and habit are similar in their basis. William James, for this reason, describes memory as 'cerebral habit'.

The theory of Recapitulation and the Culture Epoch theory that we considered in the first section, attempt to define heredity as racial memory. Instincts have, likewise, been interpreted as voluntary actions of earlier generations rendered habitual by repetition in successive generations by a process which Wundt calls *retrogradation* (6). Intelligence that guides voluntary action has '*lapsed*' in the case of instinct. There is a resemblance of another order between memory, habit and inheritance. An earlier event repeats itself under certain conditions in all of these instances.

Several thinkers noticed this fact of resemblance towards the end of the century. We have already considered the contributions of Hering and Butler. Two other writers, both in the English-speaking world, attempted to stress the phenomenon. Laycock, reference to whom has been made in an earlier chapter, published an essay entitled "A chapter on some organic laws of Personal and Ancestral Memory" in 1879. Orr published a treatise "A theory of Development and Heredity" in 1893. The resemblance between habit, heredity and memory was perceived by both of these thinkers.

The general line of argument of this school of thought may be summarised as follows : When a series of phenomena is often repeated it tends to reproduce itself

under the conditions of original stimulation, though the latter may become weak through the passage of time. Evolution of living forms is only the repetition of a series of phenomena which has already been produced an immense number of times. In fact, evolution is a particular instance of this general law which can be called that of memory. Heredity, then, is memory that recurs in the course of the evolution through sexual reproduction. "L'hérédité n'est que cette mémoire dans l'évolution des produits sexuel." (7)

Semon attempts to provide a well-defined conception that would serve as the basis of relation between the three orders of facts, habit, memory and heredity. As he says: "I have tried to deduce from a common property of all irritable organic substance—namely, that of retaining revivable traces or engrams,—a number of mnemonic laws, equally valid for the reproductions commonly grouped under memory, habit or training and also for those which come under the head of ontogenetic development, inherited periodicity, and regeneration—laws common in fact to every kind of organic reproduction." (8)

A new set of concepts has to be devised for reducing the three orders of facts to a common denominator. Such concepts will naturally refer to the effects of stimulation upon an organism, the retention of these effects and their re-activation under certain conditions; for, these are the phases that are common to memory, habit and heredity. Such concepts must refer to functions that are of sufficient generality to be capable of application to the three orders of phenomena. It may thus be necessary to postulate a purely conceptual scheme in order to ensure its generality. Such a procedure is not unknown in the field of psycho-physiology and biology. Hering's and Helmholtz's theories of colour-vision are conceptual schemes of this order. The simple bio-types that give rise by their union to the various intermediate values with respect to a given trait, are conceptual entities of the same order. A schema of this kind, therefore, need not necessarily be regarded as a piece of mere speculation. Its

value for the interpretation of facts gives a measure of its scientific validity.

Memory, habit and heredity may be reduced to a common denominator, if all the three be supposed, as has been mentioned above, to implicate the three phases of modification by a stimulus, retention of the effects and the re-activation of what is retained giving rise to another set of reactions. Memory and habit must necessarily possess these phases. Semon attempts to extend the schema to heredity. But such an extension implicates a particular doctrine of heredity, namely, that of inheritance of acquired characters. Hence, Semon's theory necessarily rests on the hypothesis of inheritance of acquired characters.

An organism which has not previously been subjected to a stimulus X is said to be *in the primary state of indifference with respect to X*. When the organism is subjected to X, the physiological modification that the stimulus causes is said to be the *engraphic effect*. Such an effect is retained in the system of the organism in the shape of a certain re-arrangement of the physical and chemical factors either of particular tissues or of the functional systems that implicate a number of tissues. The patterns of these physical and chemical factors are called *engrams*.

These remain latent for a long or short duration. They can be activated anew by conditions that differ from those of the original excitation; for, the first excitation has served to *condition* the engraphic effect. Any part of the original stimulus-situation may re-activate the engram. The stimulus that brings about a re-activation is called the *mnemic stimulus*, and the process of re-activation is called the *ecphory of the engrams*.

The phenomenon of *ecphory*, however, does not necessarily repeat the original effect. A new phenomenon along with the original one may arise. An instance of this lies in the process of *indirect recognition* in which the recognition-process arises side by side with the revival of the original perception. This happens, it is

said, also in the realm of the strictly biological phenomenon. One of the following may, then, be the consequence of the revival of an engram: (i) a mnemonic (i.e. revived) and a new original excitation; (ii) two mnemonic excitations; (iii) two original excitations. Such variable results arise from the working together of a new excitation along with a mnemonic stimulation. This co-operation is called *Homophony*.

All these types of *ecphory* occur in the sphere of memory, habit and heredity. But Semon admits that "for the great majority of ontogenetic phenomena an experimental test of all potential engraphic stimulations is impossible". "We can, however, by experiment adduce evidence," he goes on to say, "that compels us to regard these phenomena as mnemonic."

One evidence consists in the effects of interference with the period of parturition of *Salamandra atra* and *Salamandra maculosa*. In the case of *Salamandra atra* the stimuli of "warmth, moist air and presence of water induce large broods and premature parturition". The strength of the stimuli increases with each repetition so that the stimulus can, in the end, be entirely eliminated and "yet at gravitation, premature parturition of large numbers will take place". In the case of *Salamandra maculosa* certain other stimuli produce the opposite effect, namely, prolonged parturition and fewer progeny. Other types of evidence are adduced from the facts of experimental breeding and from experimental mutilation. These need too elaborate a discussion to be described here. Semon suggests that the stimuli affecting the parental organism somehow modifies the germ-plasm. Such modification is retained in the shape of *engrams* which are *ecphorised* in the subsequent generations. Such *ecphory* is said to occur in accordance with the Mendelian ratio.

The manner in which a stimulus affects the germinal cells is not, however, definitely ascertainable. The engrams, however they may be acquired, remain relatively unaltered. "It is the very nature of engraphic stimula-

tion that already existing engrams are never remoulded but remain as they were first imprinted. New engrams are deposited as detached and fresh creations. This characteristic of engraphic action is the essential element in the formation of the large group of alternatives in the sphere of individual acquirements, as also in that of hereditary engraphic action." (9)

Rignano attempts to elucidate the character of such engraphic action in his *centro-epigenetic hypothesis* of development. The ontogenetic factors, according to this view, are "nothing but a reproduction by internal causes" of the physiological stimulations. For, the "phylogenetic morphologico-physiological states give birth, in the point of the organism occupied by the germinal substance, to a single nervous current or excitation, the specificity of which will be a function and expression of the general system constituted by the infinite number of nervous currents or excitations simultaneously active in all the nuclei of the organism."

The successive phylogenetic states will leave in this way by their "representative currents" a characteristic specific accumulation. The germ-cells can be conceived to consist of "a large number of elementary accumulators of nervous energy". "These specific potential elements activate successively, one after another, from the beginning to the last term of development." Inheritance thus becomes a process of accumulation and re-discharge. All stimulations, psychic and non-psychic, are stored up in this manner and may reappear in some form in the ontogenetic process (10).

The conception of inheritance of acquired traits, mental and physical, as set forth above, is simple and seductive. But it would raise almost as many new difficulties as the old ones it would solve. One instance of these difficulties is atavism with respect to amentia and other psychopathic traits which reappear after many generations of healthy life. These atavistic traits often have a fresh lease of life in a new line of psycho-paths. The intervening period of healthy living does not seem

to be able to wipe off a taint of this character. There is, however, nothing inherently impossible in the line of argument that we have so far attempted to follow. As Bateson says: "I see nothing fantastic in the notion that memory may be unconsciously preserved with the same continuity that the protoplasmic basis of life possesses. That idea, though purely speculative and, as yet, incapable of proof or disproof, contains nothing which our experience of matter or of life at all refutes."

But the interpretation of heredity in terms of memory is, according to Bateson, "to substitute the more obscure for the less". The empirical evidence adduced by Semon in support of the Mnemic theory is regarded by Bateson as evidence that suggests *causes of variation*. It does not support the hypothesis of inheritance of acquired characters which seems to be regarded by some as the basis of the conception of mental inheritance (11).

§ 4. *Heredity in its Psychological Setting:* *Ribot and Ward*

Instincts, according to Ribot, constitute the largest part of mental life. The perceptual functions are inseparable associates of instincts inasmuch as they make the operation of instincts possible by showing them the way into the realm of things. Emotions have a threefold filiation. They are associates of instincts so that there is an instinctive factor underlying every emotional experience. They express themselves in the shape of intellectual outlooks and intellectual processes. They are the correlates of the organic changes. Thus, instinctive, perceptual, intellectual and emotive processes form an intimately linked pattern. Heritability of any one of these would be an argument in support of inheritance of the rest.

A second principle is formulated by Ribot in the following manner: The mental life seems to be constituted by two orders of function. Some of these are insufficiently organised and unstable; others are better organised and stable. These latter are relatively simple

in their character and are not disturbed by diseases as the former are. Such invariable functions are transmitted by heredity. Their degree of organisation is a measure of the degree of their heritableness. *Le degré d'organisation donne la mesure du degré de transmissibilité.*

Judged by this criterion, instincts on the one hand and emotions on the other would be regarded as heritable traits. And intelligence in its simpler forms when judged by this standard would, likewise, be transmitted. The more the intellect grows in complexity the less heritable it becomes. Descartes' conception of *innate ideas* gets a new interpretation in the light of this view. According to Ribot the *innate ideas* are modes of intellectual operation implicit in the mind, all unknown to the individual personality. They are heritable traits. ("Sont en nous d'une manière virtuelle, qu'il y a des vérités gravées dans l'âme qu'elle n'a jamais connues, c'est soutenir au fond que, dès que l'âme existe, elle possède tous ses éléments constitutifs.") These, however, are not individual but racial acquisitions. Heredity reproduces only the racial experience ("L'expérience de la race et non de l'expérience individuelle : elles sont le produit de l'hérédité.") (12)

Ribot, then, is largely a believer in what we to-day know as Hormic Psychology. Instincts and emotions are the basic constituents of personality. All other mental functions follow their lead. All the modes of mental life build up a unitary pattern so that one cannot be thought of without the other. Heritability of one or more constituents of the pattern proves the heritability of the rest. Some of these elements are overt, as instanced by instincts and emotions. Some of them remain incipient, as are the elementary modes of thought. The connection between some of these as members of the same pattern are obvious as, for instance, between instincts and emotions. The relationship, however, is less apparent in the case of perceptions and the instinct-emotion complex. Nevertheless, all of these belong to

the same psycho-biological reality which carries itself forward through generations.

James Ward pursues a line of thought similar to that described above. According to him, as also for Spencer and Wundt, "experience" in the past becomes 'instinct' of the present time. The continuity between the past and the present is said to be maintained, according to Ward, by an entity conceptually posited and called *psychoplasm*. This, however, should be clearly distinguished from the 'mind-stuff' on the one hand and the psychological individual or the individual, subject on the other. Psychoplasm is a continuum of experience or, as Ward calls it, *the presentational continuum*. It plays a part similar to that of the *mneme* and the unconscious memory; and it is continuous with the latter. About its beginning we can say nothing. But we know that all clearly outlined forms of experience arise from its differentiation. Men resemble in these differentiated forms of experience, thoughts, imaginations and perceptions, in their attitudes, feelings and purposive behaviour. Thus, a correspondence may be discovered between the mental functions of the parent-stock and those of the progeny-stock. The discovery of such a correspondence is essential for proving inheritance.

The *subjects* or the *selves that possess* these varied forms of experience, cannot, however, in any sense be said to resemble one another. There is, thus, no evidence of inheritance so far as the *individual subject* or the *self* is concerned. The *mental functions* resemble. Hence, the psychoplasm which differentiates into these functions may be conceived to be the medium of mental inheritance. And "some connection between this and the *bio-plasm* or the germ-plasm is no longer inconceivable." Mental inheritance is either based on or parallel to the process of biological inheritance.

But inheritance is only a *possible* hypothesis, not a *necessary* one. For, psychologists can know nothing directly about inheritance; nor is it possible to distinguish between what is inherited and what is acquired. It is,

however, necessary to "suppose all discernible complexity and differentiation among presentations to have been originated, i.e., experimentally acquired, at some time or other". It may be an acquisition of the individual, of the family or of the race. But psychology is concerned mainly with interpretation of the process of differentiation of particular experiences out of the presentation-continuum. And, so long as this is conceived to be the task of psychology, "we may disregard the fact that it has not actually been, as it were, the product of one hand dealing with one *tabula rasa*, but of many hands each of which, starting with a reproduction of what has been wrought on the preceding *tabulae*, put in more or fewer new touches before devising the whole to a successor who would proceed in the same manner" (13).

§ 5. *Psychology Without Heredity*

Ward, in the discussion of mental heredity summarised above, hints at three alternative positions that the psychologist may reasonably assume. The closing lines of the last section suggest (i) that it is not necessary for the psychologist, in describing the process of differentiation of mental life, to come to any decision in regard to the problem of mental inheritance. Psychology should maintain a silent neutrality with respect to the issue. (ii) Secondly, the concept of *psychoplasm* which Ward introduces, suggests the possibility of inheritance of mental traits through the mediation of some order of consciousness. (iii) Ward holds, in the third place, that the experience of the past generation may, in some manner emerge as instinct in the progeny. There is, thus, a process in which acquired characters are inherited and play new rôles in the psycho-physical economy.

The first of these conceptions, as elucidated by later schools of thought, will be considered in the present section. The other two views will be discussed in the following sections.

It is not practically possible to ascertain the nature

and number of traits that are inherited and of those that are acquired. Habit formation begins, according to Watson, in the embryonic stage. The hereditary patterns, whatever they may be, are superseded by the more recent acquisitions. Hence, it is not possible to determine at any stage what is nature and what is nurture (14). This trend of thought is followed up by Kuo and others in their approach to the problem of instinct. A behaviour-tendency, according to this way of thinking, can only arise "as a result of previous experience of the organism—that is, as a result of previous performance in the presence of adequate stimuli". Every form of behaviour must thus be conceived as an interaction between an organism and its surrounding objects. This proposition, however, denies only the inheritance of behaviour patterns. It does not and cannot deny biological inheritance. Hence, Kuo says: "That instinct has a definite inherited neural pattern few students will deny." It is upon this inherited basis that the trends of reaction that are called instincts arise. Instinct is a complex response pattern built out of a great many "units of reaction". While the units are the "native endowments" or hereditary, the pattern built out of these depends upon the acquisition of the individual in the setting of a complex environment. Since the organism adjusts itself to the environment mainly in terms of these complex patterns, psychology is concerned with the acquired behaviour alone. Thus, psychological interpretations exclude the consideration of heredity (15).

A similar conclusion may be arrived at upon a more cautious analysis of the psychological situation. "All reactions are definite responses to definite stimulus patterns, and the exact character of the response is determined in every case by *the inherited constitution of the organism and the stimulus pattern*" (16). Hence, Kelly concludes, on the basis of a mathematical analysis of the contributions of nature and nurture, that "there is no means of differentiating between the sum of the environmental factors and the original nature impetuses; for, the

final attainment is not the sum of parts but sum of products" (17).

Psychology, therefore, must reconcile itself to leaving heredity out of account in the interpretation of mental phenomena. We cannot estimate the value of heredity in the determination of mental and behavioural patterns. The variations of the values of inherited patterns cannot be readily correlated with those of the mental functions. Hence, psychology, from the point of view of its method, must abandon the hypothesis of heredity of mental traits or behaviour traits.

But such a procedure may involve far-reaching consequences. It may be necessary to abandon even the "units" of behaviour of which Kuo speaks. For, no unit is "a simple unit" unless it be postulated as such. And any complex response raises the problem of instinct over again. We have no unit in terms of which we can represent the character of a reaction. When we reach this stage, we have a break between human and animal psychology. We have to let go by the board not only instinct but all the rest of the interrelated modes of behaviour. And, finally, we lose sight of the continuity of individual development (18).

§ 6. *Mental Mediation of Inheritance: Psycho-analytic and other Views*

The "presentational continuum" as defined by Ward serves as the mental medium of inheritance. Similar types of mediation have been postulated by earlier thinkers and by later ones. We shall consider this question in the present section.

Von Hartmann attempts to ascertain the nature of the causal factor that obtains between the conscious motive and the "will to perform instinctive acts" (zwischen dem bewussten Motiv, und dem Willen zur Instinct-handlung). Such connection is established through unconscious ideas and attitudes of thinking (durch unbewussten Vorstellen und Wollen zu denken). An enquiry

into the basis of this connection through the unconscious leads us to the mechanism of inheritance.

Von Hartmann supposes "that in the constitution of the brain, the ganglia, and the whole body in respect of morphological as well as molecular-physiological condition, certain predispositions can be established which direct unconscious intermediaries more readily into one channel than into another". These predispositions can each be acquired through repetitive and habitual actions. They cut in this way a "deeper and deeper channel, until in the end" they leave indelible traces whether in the individual or in the race. And, they are "called into being by the unconscious formative principle in generation, so as to facilitate action in a given direction".

The individual organism is perpetually solicited by situations that stimulate *motives*. The '*Character*' of the individual is "the sum of the individual methods of reaction against all possible motives". Character defined in this manner "depends essentially upon a constitution of mind and body acquired in some measure through habit by the individual, but for the most part inherited". Instincts as reactions to motives represent the racial character. They possess "an unconscious knowledge arising out of no sensual impression and yet invariably accurate". This knowledge is passed on from generation to generation through what has been called in this context the unconscious (19).

The views put forward by Von Hartmann have their parallels in Jung's theory. The concept of the unconscious, according to Jung, is an exclusively psychological concept derived empirically as a "boundary-concept" which subsumes various orders of experience that do not appear in the field of consciousness. The nature of the unconscious, however, remains unknown. Experience "can affirm nothing as to what the unconscious content may be. It is idle to hazard guesses about it because what the whole unconscious content could be is quite incalculable."

It is possible, however, to distinguish between a per-

sonal and a racial unconscious. The former embraces "all the acquisitions of the personal existence—the forgotten, the repressed, the subliminally perceived, thought and felt". There is, however, another order of unconscious contents which "do not originate in personal acquisitions but in the inherited possibility of psychic functioning in general, viz., in the inherited brain-structure" (20). The "mythological associations", fables and symbols which can "spring anew" in every age and time, represent the unconscious in this racial and collective aspect.

Man, thus, inherits a general possibility or mode of "psychic functioning". This is parallel to what must be presumed to be the general character of the brain. It could not be a mere reflection of the brain. For, Jung looks upon the unconscious as an "exclusively psychological concept". The contents of racial experience that man inherits are limited, then, by the general direction of mental life and by the brain structure that corresponds to the trends of mental operations.

Mental inheritance then, according to Jung, is of three orders: (i) Inheritance of the general trend of consciousness; (ii) inheritance of the contents of racial experience; and (iii) inheritance of the brain-structure which determines the first item and possibly, also the second one. Since the proof of inheritance in a rigid sense can be obtained only from an analysis of the *contents* of racial experience, the unconscious is to be regarded as the medium of heredity.

The social, physical and traditional determinants of mental contents are not given adequate importance in the schema proposed by Jung. Freud's later thought gives adequate weight to all of these. The super-ego, as conceived by Freud, is essentially a product of tradition and social stimuli. The ego has three sets of determinants (i) in the super-ego, (ii) in the stimuli of the external world that operates through the perceptual consciousness and (iii) in the *Id* that supplies it with the dynamic energy needed for its adjustments to the external world. The *Id* is the repository of the instinct-energy,

a store that has been slowly laid in the course of the long racial history. As in the case of Von Hartmann's conception of the unconscious, "it interpolates," says Freud, "between desire and action". Social tradition and genetic history, external stimuli, and inheritance that instincts carry in themselves, serve in this way to define the character of the personality.

The *Id*, however, seems to be the most important factor in this scheme. The ego is but a part of the *Id*, separated from the main body by its proximity and intercourse with the external world. The super-ego, too, seems to shade off into the *Id* and draw upon its store of energy. Hence, the *Id* is the main foundation of the personality-functions.

The contents of the *Id* "are virtually immortal and are for whole decades as though they had only recently occurred. They can only be recognised as belonging to the past." The *Id* is "somewhere in direct contact with somatic processes and takes over from them instinctual needs and gives them mental expression" (21). The somatic processes undoubtedly reflect the pattern revealed in the genealogical tree. The instincts that the *Id* borrows from them hark back to the past history of the race. The *Id*, therefore, is as much a carrier of inheritance, taken in its racial rather than individual significance, as Jung's unconscious. Such would be a fair interpretation of Freud's recent views.

The *Id*, however, determines the mental life in all its aspects. It determines the super-ego that represents the social and moral ideals of the self and regulates the functions of the personality in every crisis. It also determines the ego that uses, more or less effectively, the energies available to the organism in a given situation. Finally, it carries forward vast stores of energy, more or less undated and unspecified by the past, to be employed as exigencies of life demand. The past experiences, the racial inheritance and instincts that represent the gift of far-off generations thus come to life through the mediation of the *Id*. Philosophical romanticism that prompted

Von Hartmann's philosophy finds an echo and a support in the evidence of psychopathology.

Freud is, indeed, a pronounced Lamarckian, a believer in the transmission of acquired experiences, just as much as the rest of the writers whose views have been considered above. McDougall points out that even in his earlier writings Freud looks upon "constitutional pre-dispositions" as "the after-effects of the experience of an earlier ancestry". He believes that "without acquired characters there would be no heredity". This principle is applied to a special problem, that of phantasy. "I believe," says Freud, "that these primal phantasies are a phylogenetic possession. In them the individual, wherever his own experience has become insufficient, stretches out beyond to the experience of the antiquity where his own experience has become rudimentary. * * * the child in its phantasy simply fills out the gaps in its individual experience with the prehistoric experiences." (22)

Freud, then, tries to interpret the fact of mental resemblance between ancestors and their progeny in terms of three factors : (i) The *super-ego* carries forward the social tradition which imparts the same stamp on the experience of successive generations, allowing some types of mental contents and rejecting others. (ii) The *perceptual consciousness* brings into operation the effects of the environments which again endow the mental life with a characteristic structure. (iii) The '*Id*', as the repository of 'Undated energy' and of contents which are 'virtually immortal', is somewhere in touch with the somatic processes. '*Id*', then, represents the mechanism of inheritance.

But the nature of the somatic processes remains indefinite. The character of 'contact' that '*Id*' has with it, is still more problematic. The manner in which 'instinctual needs' are expressed mentally, is not elucidated. The view concerning the physical basis of inheritance, then, is presented as a broad suggestion. And,

without a specification of the physical basis, the '*Id*', as a psychical entity, becomes the medium of inheritance.

All the views considered above attempt manifestly to define a '*repository*' of past experience, individual and racial, rather than inheritance. The fact of conservation of experience can only be proved by a subsequent revival, in some form, of what is retained. In this way a repository of past experience on a racial scale indirectly implicates inheritance. But the concept of heredity has a more specific significance. A demonstration merely of the fact of resemblance between the traits of ancestors and descendants is not enough to establish the hypothesis of heredity. It is necessary that a definable relation should be discovered between the frequencies or the intensities of traits as found among several generations of family groups. The theories discussed above do not satisfy this condition. They stress only the qualitative resemblance of mental traits past and present and suggest conservation as the cause of such resemblance.

An unconscious repository of past experience is, in principle, the memory-function. The individual memory and the racial memory interlace in the unconscious, and they become even identified to some degree. Inheritance, then, is said to consist (i) in the revival of the contents of the unconscious and (ii) in the distribution of the various phases of such experience over several generations. In this way, the musical talent acquired by the forbears of the gypsy may appear distributively in the progeny as a deepened sense of rhythm in some cases, as a marked acuity in tonal perception in other cases, as vocal ability in a third group and as heightened aesthetic sensibility and sense of harmony in still others.

The theories of heredity based on the unconscious raise two difficulties: (i) In the first place, the objections associated with the hypothesis of inheritance of acquired characters apply here with greater emphasis. For, the acquisitions in question are taken *en masse* for a whole racial group. It is difficult to conceive how any part of

such acquisition could influence an individual's genetic element.

(ii) Secondly, it is difficult, if not impossible, to attribute to the racial memory any physical basis. As McDougall says: "One of the difficulties in regard to individual memory is to imagine how a wealth of material traces (organized in an inconceivably elaborate fashion) adequate to the immense stores of organized knowledge and facility achieved by any well-educated man can be packed away in those parts of the brain (amounting to about half of it), not known to be directly concerned in movement and sensation. Yet, in racial memory this difficulty of conceiving a material basis becomes even greater ; for here the task is to conceive that the single egg-cell can contain the multitude of organized traces or engrams required for the guidance of all the morphogenetic processes as well as those determining all instinctive or innate mental capacities."

Memory, according to McDougall, is meaning in its essence and it is conserved as a schema of *dispositions*. These are re-activated in the shape of ideas, feelings and imagery through the stimuli of the environment. The stimuli, however, directly operate on the body, and particularly on the nervous system. Only the dispositions that become concrete ideas and images under the condition of stimulation, become linked with the neural factors. Memory may thus remain latent as dispositions, as psychic functions that need not have a necessary correspondence with the body. But dispositions, which are associates of temperaments, may be conceived as heritable. For, temperaments are said to be heritable functions. Since memory is latent in the disposition, there should be no difficulty in thinking of it as a heritable factor (23).

McDougall points out the radical change in the outlook which would be consequent upon the acceptance of individual and racial memory as determining factors in heredity : "The identification of individual with racial memory, and of racial memory with the guiding factor

in morphogenesis, must result, if it should become generally accepted, in the pervasion of all biology by psychology ; all or most biological processes will be regarded as psycho-physical ; the psychical factor being, not merely epiphenomenal, but of prime explanatory importance."

Such a theory would avoid the difficulties in regard to the medium of inheritance in the sphere of mind. But, then, the theory would also substitute the conception of the unconscious as the mediator of inheritance by *saṃskāra* and *karma*. Each psychic personality would be thought of as carrying a sheath of dispositions into which memories lie implicit. And these propel the ego towards the specific goals for which the past life has prepared it. The theories of the unconscious as the mediator of inheritance thus drive us from the field of genetics into that of spiritualism and esoteric theology.

§ 7. *The Evidence of "Reflexology":*

Pavlov and Bechtrev

We have already seen in a previous section that there is no way of discriminating between what nature gives and what nurture adds. The total behaviour pattern at any stage is a product rather than a sum. The stream of inheritance, then, brings to the surface resemblances rather than identities. We can say of this stream, as Heraclitus said of reality as a whole, that we cannot dip in the same river twice.

H which is any inherited trait is a product of N (nature) and T (training or nurture). H, then, = N.T. But in the next generation, there is no more H but K which is = H.T. There is only a certain correspondence between H and K. Such correspondence signifies that both the elements N and T have been passed on from one generation to another. In other words, it is not only what nature gives but also what the individual organism acquires that has been transmitted by heredity. Inherit-

ance of mental traits, then, as was suggested in the context of our discussion of James Ward's views, implicates the inheritance of acquired characters.

Pavlov demonstrated how reflex responses could be *conditioned* by a *stimulus-situation* which might be in a close time-or space-relation with the stimulus that releases the reflex. If the stimulus A releases the reflex R and if B be in a close temporal or spatial relation with A, B would release the reflex R. A *B-R connection* would, thus, be established and R is now a *conditioned reflex*. Pavlov suggests that such a relationship may be operative not only in the life of the individual but also in that of later generations.

"It is highly probable," says Pavlov, "that the newly formed reflexes (individual) under the continuance of uniform conditions of life during several successive generations pass over into constant reflexes (generic). This must be one of the constantly acting mechanisms in the evolution of the animal organism." The physical basis for conditioned reflexes lies in the central nervous system. "In the highest parts of the central nervous system," says Pavlov, "there are the endings of the finest and most varied analysers by which the smallest elements of the external world are isolated and brought into fresh connections with the external world, to form the conditioned reflex" (24). Inheritance of conditioned reflexes, therefore, implicates the inheritance of the higher nervous organisations as functional units.

The view, as presented above, is based upon Pavlov's own book in its English translation. McDougall, however, states that the distinguished author no longer believes in the view previously held by him. McDougall says: "Dr. Anrep was so kind as to inform me that Pavlov has authorised him to insert in the volume of translated lectures a note to the effect that his various statements upon the hereditary transmission of "the conditioned reflex" are revoked entirely, serious defect having been discovered in the process by which the positive conclusions had been reached." (25)

Pavlov's theory of inheritance of conditioned reflexes has been widely generalised and applied to a large range of psycho-physical situations by his followers, especially by Bechtrev. The general theory underlying such wide application of the conditioned reflexes may be stated in the following manner: (i) The nerve cells, it is suggested, are characterised by special molecular motility, as a result of which every stimulation so changes their molecular condition that a stimulus similar to one which has previously occurred, arouses the reflex with particular facility. (ii) "The neuron connections in the central organs adjust themselves appropriately, as a result of which, after frequent repetitions, beaten tracks are established as paths of least resistance, which can, to a certain extent, be hereditarily transmitted in the form of certain dispositions or tendencies." (26)

This schema is said to explain individual behaviour in terms of "persistent transmission, through a number of generations, of the appropriate reactions which are stamped in the nerve centres of the ancestors by their experience and take the form of a particular tendency or predisposition to similar reactions under appropriate conditions, just as man inherits certain tendencies". The mechanism explains the inheritance not only of *conditioned* reflexes but also of what has been called the *mollification* of behaviour. It is suggested that diminution in the intensity and range of impulses and desires, for instance, blood-thirstiness of animals or their mutual aversion, may be effected through changes in the environment. It is further suggested that these diminished or *mollified* forms of behaviour and impulses may be transmitted from one generation to another.

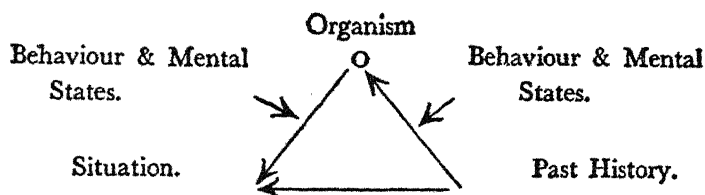
The author states that elucidation of this question is complicated in the case of human beings by the impossibility of performing experiments similar to those on animals, as mentioned above. For this reason one cannot speak of transmission of acquired forms of "reflexes" or behaviour. We can only speak of a "disposition to their more prompt formation under appropriate stimuli". Yet,

the author does not propose to attribute criminal behaviour to such a disposition. These must be attributed to social and economic factors and not to inheritance (27).

The "reflexological" arguments bring out, in the words of Bateson quoted previously, the causes of human and animal variability rather than the facts of inheritance. In the case of human heredity, the deductions from the observation of animal behaviour as found in the writings of the school, assume the form of speculation. In the case of behaviour in the socio-economic setting, the theory is shaped by political faiths rather than by scientific consideration. The limited range of facts is overlaid by a large structure of theory.

§ 8. *McDougall's Lamarckian Experiments*

Mental and behavioural responses are elicited by situations that appeal to the individual organism in specific and even in unique ways. A soldier, a medical man and an engineer each responds to the situation on the battlefield in the context of his personal history and training. Mental operations and behaviour are inseparably interlaced with the history and training that determine their quality and direction and with the situation that elicits them. We may present this idea in terms of the following diagram :



Any question of heredity in mental traits, then, would necessarily implicate the notion of inheritance of acquired characters. This view that a logical analysis of facts would readily bring out is also verified by an historical survey. We have seen that almost all thinking on the problem of heredity in mental traits has been grounded on the Lamarckian idea.

McDougall has attempted to put this idea to the test of experiment. According to him the Lamarckian hypothesis has not been subjected to adequate experimental investigation. At the same time a verification of the theory would be of immense significance to Biology, Philosophy and Psychology. For, the verification of the hypothesis will enable us to "assign to mind, or, in other words, to purposive, teleological or hormic activity, an intelligible and leading rôle in the drama" of evolution (28).

McDougall's experiment consists in training several successive generations of rats to escape from a tank of water to a dry platform. The platform could be reached by two paths, one along a dimly lit passage and the other along a brightly lit one. The latter contained an electric contrivance for inflicting a shock so that the rat could gradually learn to avoid it. The rat was lowered in the tank by hand and had to escape in order to avoid being drowned. The errors in the choice of routes are measured for the individual from the beginning to the time when the rat accepted the brightly lit way as the signal of pain.

It took a large number of preliminary experiments for this development. As a matter of fact, the procedure was not fully developed until the 13th generation of rats had been used. Each rat was led through the experiment on the first day without being subjected to electric shock. This was called the *o-day*. After that it was dropped in the tank six times a day. A rat's period of training was complete when it left the tank by the dimly lighted route *twelve times in succession* (29). McDougall presents three definite conclusions from the data that he obtained from his experiments :

- (i) There is a decided though not a regular decrease in the 'errors' committed by the rats in the selection of the route, from the earlier to the later generations.
- (ii) There is, likewise, a decrease in the range of errors. It is found that the best and the worst rats of the later generations both com-

mit far fewer errors than those found in the earlier generations.

- (iii) The 0-day choices show a marked improvement in the later generations, from the 31st to the 44th, than in the earlier generations. The following table of data, as given by McDougall, supports the foregoing conclusions :

TABLE I.

Generation stock of T.R.	No. of rats.	Average no. of errors per rat.	No. of errors made by		Zero-day choices D—B
			Best rat.	Worst rat.	
13	23	68+	30 (1)—	90+	76—62
14	10	80	42 (1)—	102	31—29
15	10	70	39 (1)—	96	24—36
16	5	73	39 (1)—	88	14—16
17	11	46	9 (1)—	147	35—31
18	22	62	15 (1)—	142	59—73
19	15	47	12 (1)—	100	44—46
21	34	37	9 (3)—	74	91—113
22	16	36	6 (3)—	89	51—45
23	26	25	3 (2)—	71	73—83
24	14	33	10 (1)—	62	48—36
25	18	38	14 (1)—	78	51—57
26	23	43	9 (1)—	75	65—73
27	32	54	12 (1)—	96	98—94
28	17	44	13 (1)—	90	51—51
29	20	50	18 (1)—	105	51—69
30	11	20	3 (2)—	56	28—38
31	38	40	3 (2)—	100	115—113
32	42	17	3 (5)—	70	137—115
33	24	33	2 (3)—	73	93—51
34	34	36	2 (3)—	88	123—81
35	29	36	0 (2)—	124	89—85
36	24	28	2 (4)—	89	96—48
37	16	13.5	0 (3)—	65	64—32
38	21	8	1 (10)—	25	87—39
39	34	14	0 (8)—	50	130—74
40	15	29	0 (2)—	87	57—33
41	30	35	6 (1)—	78	93—87
42	27	23	1 (2)—	59	94—68
43	29	20	0 (3)—	52	100—74
44	30	9	0 (11)—	32	115—65

(Explanation of Symbols: T.R. = Trained rats; D = Dimly lit passage; B = Brightly lit passage.)

The phenomenon of cross-breeding seems further to support the conclusion that the behaviour-pattern, re-

presenting escape from the tank, is transmitted by heredity :

TABLE II.

Stock	Average no. of errors per rat	Range of errors	Zero-day choices
14 hooded rats ..	178	50 — 308	41 — 43
6 female hooded rats, progeny of 14 hooded rats above	138	50 — 277	15 — 21
4 of the 6 females above which produced the 31 cross-bred progeny below	159	50 — 271	—
10 Rs. progeny of hooded ♀ of 90 errors and of T.R. ♂ of 0 errors. ..	32	0 (1) — 77	34 — 26
6 Rs. progeny of hooded ♀ of 111 errors and of T.R. ♂ of 0 errors ..	16	0 (2) — 70	19 — 17
10 Rs. progeny of hooded ♀ of 130 errors and of T.R. ♂ of 0 errors ..	33	14 — 56	32 — 28
5 Rs. progeny of hooded ♀ of 306 errors and of T.R. ♂ of 0 errors ..	80	13 — 79	15 — 15
Total of 31 cross-breds ..	37	0 (3) — 79	100 — 86

Symbols used Rs. = Rats ; T.R. = Trained Rats ; ♀ Males ;
♂ = females.

The proof of inheritance of a complex and variable behaviour-pattern of this nature is also a proof in support of heredity in acquired variable behaviour in general. Such behaviour, in the case of human beings, is most often associated with certain forms of consciousness that represent *mental traits* in the sense in which the term has been defined in the first chapter. These experiments, therefore, adduce proof in support of the hypothesis of heredity in mental traits (30).

§ 9. *Critique of McDougall's Experiments and Conclusions*

It is not to be expected that experiments that overthrow well-established beliefs in the sphere of a science would pass unchallenged. The procedure and the conclusion will naturally be scrutinised for the discovery of possible flaws. McDougall's experiments have been subjected to close examination from various points of view. There have been three broad lines of criticism : (i) In the first place, criticism has been directed by some primarily against the Lamarckian hypothesis in general in the special context of the experiments under consideration. (ii) Secondly, alternative hypotheses that may explain the facts adduced by McDougall have been suggested in the setting of the experiments. (iii) Thirdly, these experiments, laborious and protracted as they are, have been repeated by other workers for the verification of the data upon which the conclusions are based.

McDougall has answered most of his critics. He attempts to show that his experiments are free from serious errors of procedure and that the rival experiments have been carried on under different conditions. He also tries to show that there is no real foundation in fact for the alternative hypotheses.

(i) McDougall discusses the views of T. H. Morgan and H. S. Jennings who adduce arguments on the basis of the general idea that the Lamarckian hypothesis is unacceptable as an account of heredity. Morgan, in fact, considers the theory as a 'pernicious superstition'. He is not prepared to accept the theory of transmission unless he understands the nature of the change brought about in the organism through training. As he says: "What kind of change took place is not apparent. There is nothing to indicate that the effects were due to a specific kind of education connected with escape from water through a choice of exits. Until the kind of change that took place in the rats is more evident it is not possible to

discuss to advantage the outcome of this work." For, the author holds that if acquired habits were paralleled by corresponding structural changes, "heredity would become a branch of animal psychology".

Jennings says that changes induced in the unicellular organism by "many different types of environmental conditions" have been found to have been transmitted by heredity. But such evidence is not forthcoming in the case of the more complex orders of life. For, the characters which are said to be inherited, are conceived to be correlated with various *genes*. If the notion of such correlation could be made precise in the mathematical sense, the problem of inheritance would be solved. As a matter of fact, biologists of to-day are attempting to work out by mathematical procedure the intimate relation between groups of traits and groups of genes (31).

But such correlation is far from being well-established even in regard to traits that seem to be empirically heritable. The individuals who are said to belong to the class described as that of "simple, primary aments", may owe their low-grade mentality to "an extremely complex class of genetical entities". Again, the fact that we cannot "point to any factors of the environment responsible for a disease or defect does not necessarily mean that it is associated with *gene*-differences which manifest themselves throughout a wide range of environment" (32).

These reservations make the task of correlation of traits and genes exceedingly difficult. And, yet the biologist must move within the circle drawn by the principle of gene-trait correspondence. The problem of inheritance of behaviour which McDougall's experiments implicate cannot, however, be readily placed inside the limits indicated above. "It is, I venture to think, beyond the imaginative capacity of biologists familiar with what is best known to-day in embryonic development and in genetics, to suggest any rational process by which such complexities could be carried over *as a whole* from the body cells to the germ cells."

McDougall says that this is mainly an argument in

favour of remaining circumscribed within the limits of the prevailing postulates. Orthodox biology seems to suggest that the 'gene' theory must stand inasmuch as it offers an interpretation of a large group of facts, and other facts that go against the hypothesis should be explained away. This outlook, in McDougall's view, is another kind of 'pernicious superstition'.

(ii) A second line of criticism proceeds along a more helpful line by offering an alternative hypothesis for the interpretation of facts found by McDougall. Crew, whom McDougall considers to be a highly competent authority, suggests that improvement shown by the rats of a later generation may be explained on the basis of Mendelian inheritance of two traits called "Quickness" and "Slowness". These traits distinguish certain rats of the original stock though one of them may become *dominant* and the other *recessive* for a number of generations. It is possible also to suppose that the 'quickness' trait of a rat of an earlier generation is represented to a greater extent among the 'quick' rats of later generations. In this manner, the reduction in the number of errors and in the time of learning in the performance of rats may simply signify the representation of rats of a particular stock. Since McDougall has no pedigree chart of the later generations to rebut this suggestion, it offers a plausible interpretation in terms of a non-Lamarckian hypothesis.

A variant of this proposition is also suggested by Crew. The "Quickness" and "Slowness" factors may not refer to the general character of responses but to a special type of reaction, namely "*photo-phobia*". The rats learn under the conditions of the experiment to respond *negatively* to the brightly lit passage quickly or slowly. This is due to the evocation of a general tendency of negative response to light characteristic of many species among which rodents may be counted. Hence, the phenomenon which McDougall interprets as inheritance of acquired characters, is in reality the evocation of negative response to light by certain stocks of rats which possess the trait in a more pronounced form.

A similar suggestion is made by Tryon who bred two types of rats characterised as 'bright' and 'dull'. These traits were measured in terms of maze performance and it was found that successive generations represented pure lines of descent with respect to these traits. Both the strains, bright and dull, increase in vigour in the later generations. McDougall's results are explained in terms of this fact.

McDougall accepts the criticism that a complete record of pedigree is essential for the verification of his hypothesis. In its absence, he rests his case on other aspects of the data. (a) He points out that if the earlier generations of rats possessed the opposing traits, quickness and slowness, brightness and dullness, the curves of performance for the earlier tank experiments would have shown a bi-modal distribution. This is not, however, the case. (b) He further urges that theories of this type cannot explain how the 'quick' and the 'bright' strains prevail, from the 35th to the 44th generation, as shown in the table quoted above. The suggestion that favourable conditions release the traits from their state of latency, is nothing more than pure speculation. In view of these facts McDougall thinks that inheritance of these acquired traits is a more reasonable interpretation of his data.

(iii) Crew and Agar have carried on experiments similar to those of McDougall and have failed to find a progressive decrease in the number of errors in the later generations, as McDougall finds. The procedure of the experiment is also regarded as unsatisfactory in several respects. The very basis of the theory of inheritance of acquired characters is, therefore, in question.

In regard to Crew's negative results, McDougall holds that the two series of experiments, Crew's and his, did not actually follow the same procedure, for (i) Crew did not prescribe tasks of maximal difficulty within the range of rats' abilities. The more difficult the tasks the greater would be the differentiation abilities. (ii) A larger number of repetitions would be needed for learn-

ing and the constitution would be influenced more deeply.

(iii) As a matter of fact a *gradual acquisition* of the habit of avoidance is deemed to be essential for the success of the experiments. The author says: "This slowly acquired aversion from B is the main feature (perhaps the essence) of that which seems to be transmitted in the Lamarckian fashion." (33)

• These arguments and their rebuttals still leave a precipitate of relevant criticism of McDougall's experiments and conclusions. It is suggested that (i) an avoidance-habit, which the experiments under consideration attempt to cultivate, gives a doubtful measure of learning ability. Avoidance does not involve the degree of co-ordination as is necessary for a positive approach or prehensile reaction. (ii) The avoidance reaction can sometimes be due to a greater persistence of the effect of electrical shock received in the wrong exit. The diminution in the number of errors, thus, need not be due to Lamarckian inheritance. (iii) Lastly, the chance factor plays a large part in learning by trial and error. The amount of influence exerted by this factor has not been computed or eliminated (34).

McDougall's experiments, thus, still leave a large margin of doubt. The proof of the Lamarckian hypothesis and of the hypothesis of transmission of variable traits, like behaviour-patterns and mental states, is not conclusive. If the issue of inheritance of mental traits depends mainly on the Lamarckian principle, it has yet to be proved.

§ 10. *Concluding Remarks*

Man possesses more ways of thought and feeling, imagination and memory, will, attitudes and dispositions than of overt behaviour. These mental operations are learnt almost throughout the entire course of life. If these acquired modes of mental function are viewed as restricted to the span of individual life, only a small residue is left of what may be regarded as mental in character. It is for this reason that the problem of

mental inheritance has so often been interlaced with that of inheritance of acquired characters.

Yet, it is not essential that the two concepts of mental inheritance and inheritance of acquired characters should be thus associated. It is possible to think of certain abilities and disabilities as gene-linked. "The average difference between the intelligence-quotients of members of the same fraternity," says Hogben, "is reduced by less than half when all gene differences which differentiate the offspring of the same parents from one another are eliminated." It is further suggested that the various mental traits or defects that characterise races may well be conceived as gene-linked (35). Thus, the concept of inheritance of acquired traits may well go together with the gene-concept.

Lastly, the contrast between what is acquired and what is inherited is by no means absolute. The 'acquired' traits implicate certain well-specified situations in which acquisition takes place. In regard to 'inherited' traits we are told: "No statement about a genetic difference has any scientific meaning unless it includes or implies a specification of the environment in which it manifests itself in a particular manner." Differences between individuals may, thus, arise from differences in (a) the gene and (b) in the pre-natal and the post-natal environment. The former kind of difference is recognisable as a trait under all circumstances in which organisms live and grow, that is to say, under a wide range of conditions. The latter kind of difference exhibits itself under a more limited range of circumstances. A clear instance of the first is that between a normal adult and a haemophiliac. The latter is instanced by Mongolism. The gene-differences in this case require "a special pre-natal environment to make them recognisable" (36). The primary issue in the context of the problem of mental inheritance, then, is not that of the truth of Darwinism or Lamarckism. It is rather the manner of distribution of traits over a number of generations. If such distribution is well-grounded in observation, the issue whether

the traits are mainly gene-linked or mainly induced by habit and stress of the environment, comes to possess a more or less theoretic importance.

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CHAPTER XV

CONCLUSION.

§ 1. *The Range of the Problem*

It has not been the purpose of the preceding chapters *to prove* or *to disprove* the hypothesis of inheritance of mental traits. All the accessible facts that are deemed relevant in the context of the problem have been marshalled in order that the question of inheritance of mental traits, so far as these facts bear on it, can be fairly judged. Nor is it the purpose of this investigation to discover *the mechanism* of heredity. That is a problem which no amount of analysis of psychological data can truly solve. We have surveyed the different theories of heredity of mental traits in order to show how thinkers have tried to trace the transmission of traits from generation to generation. Our analysis has shown that these interpretations are not likely to be of material help in the present state of knowledge in the determination of the issue of heredity. The theories themselves rest on insecure foundations.

The task of the psychologist at the present time, then, should be to collect the data that bear upon the issue. This, however, implicates a critical estimate of the methods by which facts may be gathered. An excursion into methodology would inevitably lead us into the question of certain necessary definitions. Psychology, then, can do no better now than to direct its attention to observation of the relevant phenomena, to the refinement of its procedure, to a logical analysis of its concepts and postulates, and to an elucidation of the conclusions that the data of observation may yield.

The present enquiry has been intended, then, to

bring out the implications of the evidence adduced with respect to the problem of inheritance. We have found that the evidence in favour of inheritance is clear in some cases ; in certain other cases it is negative. It is, thus, possible to say that the prevailing methods of analysis are capable of revealing the hereditary basis of a small number of mental traits ; further analysis would show how all the mental functions are inherited.

Such a conclusion would rest on an initial assumption of a particular theory of inheritance, of the type that we have considered in the preceding chapter. It is equally possible to argue from the negative side of the evidence that no mental traits are inherited, and that psychology should do without the concept of heredity. This, too, rests, as we have seen, upon an initial assumption that the very nature of mental functions or behaviour-patterns excludes the conception of heredity.

It has not been our intention in this analysis to side with any of these contrasted views. It is quite possible to hold that some of the traits are inherited while others are not, just as it is possible to maintain that some diseases are hereditary and others are congenital or acquired. The issue, then, is not whether mental traits as such are heritable. We rather ask : *which of the mental traits, if any, may be adjudged to be heritable on the basis of the evidence adduced.*

§ 2. *A Review of the Evidence*

We have considered the evidence in support of heritability of a large number of mental traits. It is clear from the survey that the hypothesis of inheritance of some of the traits has a stronger support than that of other traits. (i) Colour-preference seems to have a racial distribution as instanced in the difference between whites, Red Indians and the mixed bloods. (ii) Visual acuity and quickness of dark-adaptation seem also to vary according to racial differences. (iii) Colour-blindness and certain other forms of sensory deficiency

have a familial distribution. (iv) A familial distribution is likewise said to obtain in regard to synaesthesia and eidetic images. (v) On the other hand, the evidence in support of inheritance of ideational type cannot be relied upon. The methods and standards for its determination may yield highly variable data.

We have seen that many of the pathological traits may be attributed to inheritance. The study of pedigree is supported in these cases by the evidence of social statistics. The phenomena of low-level or "dull" intelligence and amentia are, likewise, found to be hereditary in their basis. Here too the conclusions that the study of pedigree yields are supported by those deduced from statistical evidence.

The analysis of talents, abilities and intelligence, however, reveals an interesting state of affairs. It is not possible to explain these highly variable functions in terms of inheritance. At the same time, the study of pedigrees and even the statistical evidence suggest inheritance. It is not possible to explain the whole range of facts in terms of environment. The proper attitude, in such cases, would be to give the verdict of "not proven" so far as positive affirmation of the hypothesis of inheritance is concerned.

Intelligence, because of its great importance for all types of adaptation in the case of man, has to be studied in its various interlacings. It has been studied in the contexts of family, class, vocation and race. In none of these settings is there any clear evidence of inheritance. Some of the data create a predisposition towards the hypothesis of heredity. But such predisposition is not the same as logical proof.

We pass on to consider a number of complex psychological functions subsumed under the notions of character, desires and impulses. Certain earlier speculations incline towards the hypothesis of heredity in the interpretation of these facts. Yet, the great complexity and variability of the phenomena render it impossible to exclude from their interpretation the contribution of environment.

When we turn to the idea of personality-types, so much in vogue to-day in the forum of psychology, the hypothesis of heredity acquires a greater degree of plausibility. The types have well-defined physical characters, and no one questions their inheritance. These characters, however, are interlaced with mental traits. When an analysis is made of the data bearing upon mental typology, the types do not seem to emerge so clearly out of the mass of statistical figures. The steepness of the curves appears to be smoothed down, and factors other than heredity seem to gain in significance.

All of these lines of evidence do not lead to the hypothesis of inheritance of mental traits. We can assert with assurance that some of the traits are heritable. About certain others we have some evidence of inheritance but not complete proof. About still others, we have no clear evidence. There is, therefore, no proof for the general proposition that all mental traits are inherited. There are proofs of varying weight in support of the hypothesis that some of the mental traits are inherited.

§ 3. *Difficulties in the Study of Mental Inheritance*

(i) The principal difficulty in the determination of heritable traits arises from certain general laws that operate in the entire range of mental life. A large number of mental functions represents the combination of less complex functions. Such a combination may implicate several grades of intimacy of relation between the components. For instance, if Wundt's views are to be relied upon, perception of visual space represents a combination of two factors, vision and kinaesthesia. The stress that heredity or environment places upon either of these would determine the capacity of space-perception as a unitary mental function. We shall usually attempt to observe the inheritance of the capacity of space-perception and not of visual acuity or kinaesthesia. It may very

well be that not space-perception as a mental operation but the one or the other of its components is really a heritable trait. Our observations upon the capacity of space-perception in that case may not effectively exhibit the phenomenon of inheritance.

The same thing is true of talents and abilities. We have seen how a capacity of executing designs may depend, among other abilities, upon the vividness of kinaesthetic imagery. As a heritable trait, the latter may pursue its own trail of inheritance without implicating the capacity of drawing designs. The same proposition, as we have already seen, is true of musical talents. An ability or a talent thus appears as a new function. It secures a certain kind of adjustment and value. The degrees of adjustment and of the value secured measure the talent. Heredity of talents, then, is measured along the scale of success. But from the angle of psychology, it should be estimated in terms of the components of the talent that appear in the successive generations. Such analysis, however, is impossible both in theory and in practice in many cases. For, each complex ability makes its appearance as a unitary whole, obscuring effectively its many components.

(ii) A second difficulty in the way of observation of traits from one generation to another lies in the fact that each mental function is subject to a wide range of variation in the life of the same generation. Emotional and volitional characteristics, as well as intellectual abilities and disabilities that social memory conserves, are subject to large fluctuations when estimated without any reference to a well-formed scale. Since these techniques of mental measurement in psychology in terms of tests are of recent origin, it is difficult to compare the abilities of any one of the present generation with those of his forbears. The following data in regard to the I.Q. and the score of emotionality of several pairs of identical twins, as estimated by the Stanford-Binet tests and the Pressy tests, are given below : (1)

Pair.	I.Q.	X-O Scores.
A	99	161
A ₁	101	257
B	102	210
B ₁	94	170
C	92	221
C ₁	77	185
D	102	154
D ₁	96	221

It is not possible to say *whether the I.Q.-values and, emotivity represent normal variations of a function, or they hark back to different strains of inheritance.*

(iii) Thirdly, these variations need not be quantitative only. They may be in different directions and of different qualities. A heightened emotional and instinctive tendency may express itself in a variety of forms in the ancestor and the progeny stock. The ancestor stock may exhibit courage and a spirit of adventure ; the progeny stock may manifest restlessness and neurosis. It is difficult to trace the latter from the former.

(iv) Mental traits inextricably interlace with the stimulus-situations in a very large number of instances. The S-factors of Spearman are instances in point. And, inasmuch as the G-factors are implicated in the S-factors, it is not practically possible to trace abilities that usually secure man's adaptation to his environment, through the process of inheritance.

We have to draw our materials bearing upon the problem of mental inheritance, then, from a very small number of mental traits. In the other cases the evidence is likely to be inconclusive for the reasons noted above. We shall proceed to consider the nature of the traits that more clearly supply evidence of inheritance.

§ 4. *General Character of Heritable Traits*

It is possible to observe resemblance between the mental traits of several generations when they possess certain general characteristics. Since variability is an obstacle to such observation, it follows that traits that are found to be heritable are also *less variable*. A low degree of variability, however, may result from several circumstances. (i) A trait which can be correlated with the structure or function of a specified sense-organ shows a smaller range of variations in comparison to traits that are referred to a larger functional system. Sensory acuity and sensory defects are for this reason better recognised as heritable than the ideational type. The latter must, from its very nature, be attributed to a more complex physiological scheme. A complex physiological base often implicates a complexity in the observable characters; and the more numerous the phases of a trait, the greater is the chance of variation.

(ii) Certain traits represent a 'throw back' upon a stage phylogenetically or ontogenetically primitive. Such traits would exhibit a lower range of variability for the following reasons: A more primitive trait cannot secure an effective adjustment to a complex and changing pattern of stimuli. It does not, therefore, vary reciprocally with the stimulus-pattern. A child's fear-reaction, for instance, exhibits a lower range of variations, however variable the situation may be. The same thing is true of childish traits in a grown up person. Anger and jealousy, when they represent *regressions*, exhibit a more or less constant profile under widely changing conditions.

A primitive trait, then, does not *interlace* with the stimulus and does not alter to any marked degree with the changing values of stimuli. The qualitative and quantitative variations are thus limited within a small range, rendering observation easy. It is for this reason that amentia which marks an arrest at a certain stage in the development of intelligence, can be more easily studied. The ament mental pattern ceases to respond to

every change in the external situation, and thus presents a certain uniformity of character.

(iii) Other pathological traits such as psychasthenia, manic-depressive insanity and schizophrenia are recognised under varied conditions of life. This is possible inasmuch as their symptoms retain a certain identity of arrangement and quality. Such an identity is not easily disturbed; and the responses do not reciprocally change with the stimulus as we find in schizophrenia. The relation between the different items of the symptom is probably determined in these cases by a deep-seated psycho-physical process rather than by the vicissitudes of the personality in its relation to the physical and social factors.

(iv) There is some evidence for presuming heredity of several traits when they reach a certain maximal value. The instances of sensory acuity, high grade intelligence, as found in the Darwin-Wedgewood family group, the Edwards family group, and highly developed musical or mechanical abilities, supply evidence on this point. The principle seems to be as follows: Every trait normally filiates out in several directions of variability. A maximally developed trait, however, appears to 'mark time' in the same form before new sallies of growth are made, or before the trait disintegrates into its components, as the genius degenerates into the mattoid. There is a rough analogy between this phenomenon and that of *plateau* in the learning curve. In both, variability as expressed in growth has come to a temporary halt; and in both the profile of the trait, qualitative and quantitative, is recognisable. In the case of *plateau*, the process of marking time covers minutes, hours or days. In the context of inheritance it spreads over generations. Such a halt in normal variability offers an opportunity to observe how far a particular trait is heritable.

The principal condition, then, under which traits can be studied with respect to their heritability is diminution of their variability. This takes place under several conditions of which four have been indicated above. The

study of inheritance of mental traits, then, has a limited set of materials. Researches in mental heredity must necessarily follow an uncertain and a hesitant course beyond this relatively narrow boundary.

§ 5. *Final Remarks*

"In the psychological domain, on account of its decisive importance for civilisation," says Lenz, "lies the core of genetics" (2). Yet, it is recognised by every one that the approach to the problems of genetics from this angle is beset with grave difficulties in the methods of study, in the definition of facts and in their theoretic interpretation. The only basis upon which we may successfully approach the issue, is that of the observation of 'phenomenal' characters of mental traits. To seek for basic hormones, archetypes or genes that correspond to mental traits is to enter the uncharted seas of speculation. As Peters says : "The basic facts of experience in the practical investigation of heredity is the psychical similarity between blood relations. The ascertainment and analysis of this, the discovery of its phenomenal laws, must always remain the foundation of a psychological science of heredity." (3)

Much of these "phenomenal likenesses" will be found capable of interpretation in terms of the empirically observable features of the environment. Occupations and family milieu, traditions and social norms would account for many of the mental functions in which the blood-relations resemble. In certain other cases the resemblances between the members of a family would be found to be as great as between persons who do not possess a common family tie. A large-scale statistical enquiry would be necessary to bring out whether blood-relations possess a higher degree of similarity with respect to a mental trait than do persons not so related. It will be found that many striking family resemblances entirely melt away. They are found to represent merely the normal process of variation in particular directions that mental functions undergo everywhere. When such

variability is present on a large scale, we must be prepared to meet coincidences within a family and outside.

But when all these factors, environment, variability and chance, are duly given their share, a number of residual problems still remain. The mental life of ancestors somehow seems to project itself across the distance of time and into the processes of civilisation. Man seems to possess a true mental kinship with his forbears in addition to the material relation through blood. Bergson calls up the picture of a march of men from the remote past in which "each generation is leaning over the generation that shall follow. The living being above all is a thoroughfare, and the essence of life is in the movement by which life is transmitted." (4) The past whispers to its successor the secret of life as well as the secret of mind. The true value of what is transmitted may be adjudged in its own way by each succeeding age. But all the same, there is a mental legacy to receive, to exploit and to bequeath.

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- (3) *ibid.*—Quoted in p. 566.
- (4) Saleeby—*Progress of Eugenics*—Foreword by Bergson.

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